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A PARTIAL STUDY OF THE DEVELOPMENT AND APPLICATION OF DYNAMIC PROCESS CONTROLS TO GLASS PRODUCTION

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I. Abstract

In attempt is made to construct dynamic process controls for the evaluation of batch house and furnace melting continuity. Application is made both to the outcoming ware and to the doghouse glass. The softening temperature and the density of the glass are two measurements primarily concerned. Continuity and working range are shown to be corollaries of per cent pack. Routine daily analysis of glass is implied by the use of these physical measurements in conjunction with other similar measurements.

II. Procedures

The standard-density comparator was used for the measurement of room temperature density. The softening temperature was found by extrapolation of the viscosity curve given by the fiber elongation viscosimeter described by Poole.[1]

Glassware and annealed glass slugs were used for the density measurements. Fibers drawn from the doghouse slug and intercepted gobs from the feeders were used for the softening temperature determinations. These measurements were made daily and around the clock to establish time lags and shift differences.

III. Theoretical Considerations

We assume that in the narrow range of variation from the average container composition that the effect on viscosity and density of oxide constituents of the glass would be very nearly linearly, additively related. That is to say that their effects may be represented by the following type of partial differential equation:

$$dx_j = \sum_{k=1}^{n} \frac{\delta x_j}{\delta y_k} dy_k = \frac{\delta x_j}{\delta y_1} dy_1 + \frac{\delta x_j}{\delta y_2} dy_2 + \ldots + \frac{\delta x_j}{\delta y_n} dy_n \quad (j = 1, 2, \ldots, n)$$

where there are n oxide constituents involved, and

y_k = the k^{th} oxide constituent
x_j = the particular measurement concerned
dx_j = the change from axerage x_j
dy_k = the change from average y_k
$\frac{\delta x_j}{\delta y_k}$ = the effect on x_j of a change in y_k

If we were now to include further measurements such as high temperature viscosity, high temperature density, alkalinity, index of refraction, and so on until we obtained n distinct measurements, we would then have formed n equations in n unknowns which could be solved for the changes in the various oxide constituents. Normally we would only be interested in the five major oxide components. Since we could find the per cent silica by difference, four equations in four unknowns would yield the change from average of silica, aluminum, calcium, magnesium and alkaline oxides. This solution would be readily accomplished by either determinants or matrix theory; preferably the latter. Solution by matrix theory is as follows:

$$(X) = (A)\ (Y)$$

where:

$$(X) = \begin{bmatrix} dx_1 \\ dx_2 \\ \cdot \\ \cdot \\ \cdot \\ dx_n \end{bmatrix};$$

$$(Y) = \begin{bmatrix} dy_1 \\ dy_2 \\ \cdot \\ \cdot \\ \cdot \\ dy_n \end{bmatrix}$$

$$(A) = \begin{bmatrix} \delta x_1/\delta y_1 & \delta x_2/\delta y_2 & \ldots & \delta x_1/\delta y_n \\ \delta x_2/\delta y_1 & \delta x_2/\delta y_2 & \ldots & \delta x_2/\delta y_n \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \delta x_n/\delta y_1 & \delta x_n/\delta y_2 & \ldots & \delta x_n/\delta y_n \end{bmatrix}$$

then:

$$(Y) = (A)^{-1}\ (X) = \begin{bmatrix} \frac{A_{11}}{A} & \frac{A_{21}}{A} & \ldots & \frac{A_{n1}}{A} \\ \frac{A_{12}}{A} & \frac{A_{22}}{A} & \ldots & \frac{A_{n2}}{A} \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \frac{A_{1n}}{A} & \frac{A_{2n}}{A} & \ldots & \frac{A_{nn}}{A} \end{bmatrix} (X)$$

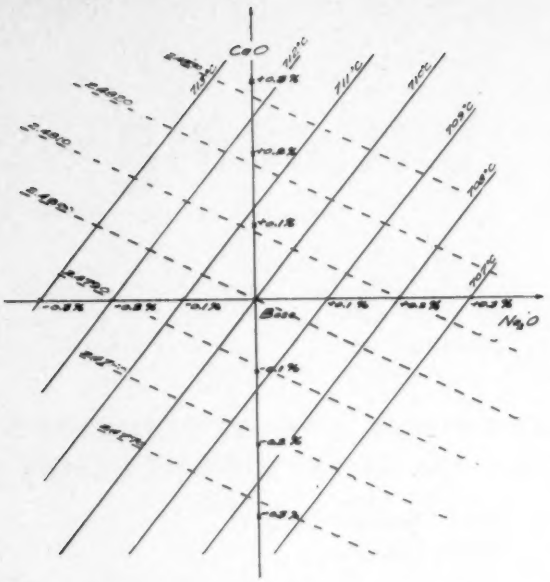

Fig. 1. Lines of equal density and viscosity which deviate from a given base.

$$= \frac{1}{A}\begin{bmatrix} A_{11} & A_{21} & \cdots & A_{n1} \\ A_{12} & A_{22} & \cdots & A_{n2} \\ \vdots & \vdots & & \vdots \\ A_{1n} & A_{2n} & \cdots & A_{nn} \end{bmatrix} (X) = \frac{(A)\ \text{adjoint}}{/A/} (X)$$

where: $A = /A/ \neq 0$

and, A_{kj} denotes the transposed cofactors $(A_{jk} = [-1]^{j+k}M_{jk})$ of the elements of (A),

and M_{jk} is the n—l order determinant obtained by striking out the j^{th} row and k^{th} column of the original n order determinant.

For a given base composition, the values of A need be computed only once, and the final computation for dy_k can be run off routinely. It is interesting to note that this kind of system yields an analysis of the major components faster than and as accurately as the standard wet analysis. The following material is devoted to application of softening temperature and density measurements to process control.

IV. Applications

Analysis. Since we are going to be dealing with only two measurements whose component properties are already well-known, we shall be interested in silicon, calcium and alkaline oxides. Putting these in equation form, using approximate figures, we have.

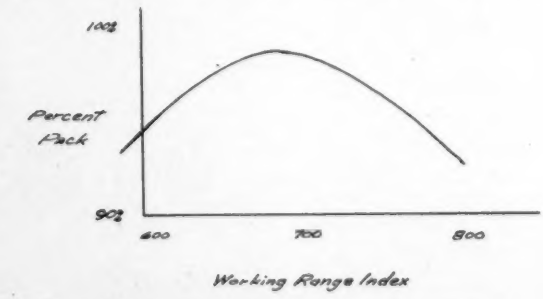

Fig. 2. Working range index versus per cent pack.

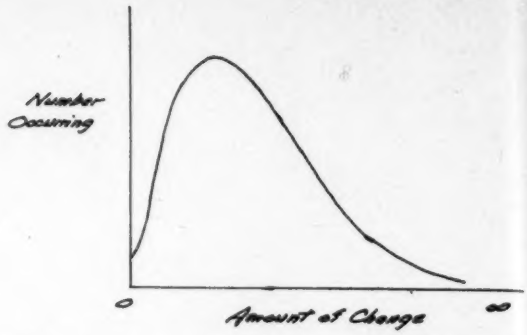

Fig. 3. Change in composition versus the occurrence of change.

$$dV = \frac{\delta V}{\delta C}\, dC \pm \frac{\delta V}{\delta N}\, dN$$

$$dD = \frac{\delta D}{\delta C}\, dC \pm \frac{\delta D}{\delta N}\, dN$$

where: dC = change in CaO
dN = change in Na_2O
dV = change in softening temperature
dD = change in density

and then: $dV = 8\ dC - 10\ dN$
$dD = 106\ dC \pm 50\ dN$

Now, to obtain graphic representation, we merely mark off units of plus and minus 0.1, 0.2, 0.3% on each axis, label the horizontal axis Na_2O and the vertical axis CaO. The slope of the softening temperature lines is

$$-\left[\frac{-10}{8}\right] = 1.25.$$

The slope of the density lines is

$$-\left[\frac{50}{106}\right] = -0.472.$$

Using the facts that a 1% Na_2O increase yields a 1.0°C. softening temperature increase, and that a 1% Na_2O increase yields an increase of 0.0005 gm/cc density, we can then draw in all the lines of equal softening temperature and density as shown in Fig. 1. Density lines will be 0.0010 apart and softening temperature lines will be one degree Centigrade apart, each from their given base.

This graph could, of course, be converted to pounds of soda and limestone excess or deficiency. If, however, we were using dolomitic stone or any mixture of calcite and dolomite stone, the slope of the softening temperature lines would be increased and the slope of the density lines would be decreased.

These two measurements used in conjunction with standard routine light transmission, color, cord, seed count, etc., will often aid in speeding an analysis of what has happened, what is happening, and what will probably happen.

Correlation with Per Cent Pack. Under the assumption that continuity of composition was of prime importance, we chose the vector distance from one day's measurement to the next as our unit of continuity. This distance was then correlated with the per cent pack on the same shop from which the measurements were made. It was as-

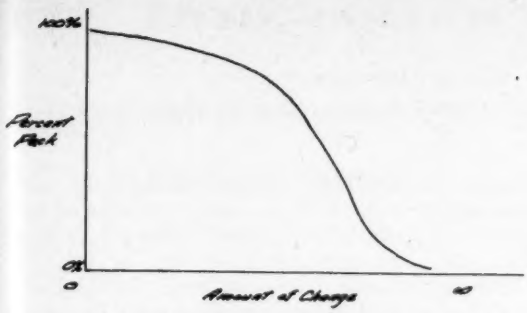

Fig. 4. Change in composition versus per cent pack.

sumed and later proved that the correlation thus found was linear.

When the vector distance increased, the per cent pack decreased eighty per cent of the time. Fisher's "F" test and "Student's t" showed that the two subsets were from the same set. The vector distance was then used to predict the per cent pack. Pearson's Chi-Square distribution showed that there was no significant difference between the predicted and the actual per cent pack.

Working Range. A working range index based on extrapolated softening temperatures, gob temperatures, and specific heat values was then linearly correlated with the per cent pack. The broad general trend in flint production was higher per cent pack with wider working range index. This, however, was on the assumption of linear correlation. By plotting a scatter diagram of the data, it became rather obvious that the line of best fit was not a straight line. The data was then reworked on the basis of a second degree line of best fit. The general trend and linear correlation previously stated neatly displays one of the pitfalls open to quick and general methods of statistical analysis and one which should be resolutely avoided by any analyst.

Analysis of variance showed that the straight line was not significant, while the parabola fitted the data with a significance of $p = 0.005$. Clearly, the working range index was a good measurement and correlated with output as measured by the per cent pack. The parabola also yielded a maximum point of per cent pack and its corresponding working range. It was then an easy task to state the optimum batch for the given machine set-up. Figure 2 shows the relation found on one shop between the working range index and the per cent pack.

Doghouse Samples. Slugs were taken at the doghouse in an attempt to predict the values which would be obtained from the ware on the next day. Softening temperatures and density measurements were made on the slugs. These measurements of the slugs were then linearly correlated with the measurements of the ware a day or so later. Both the density and the softening temperature showed high, positive correlation with the ware after allowing a time lapse according to the size and pull of the furnace.

Setting Control Limits. "Two Sigma" limits were chosen as the upper and lower control limits since they include approximately ninety-five per cent of the normal statistical distribution. The allowable range of variation for our measurements found in this way compared favorably with the calculated range which would be expected of our weighing accuracy in the batch house. These controls, however, would not always be enough, for a change from the lower control limit to the upper control limit could well be intolerable for consistently high packs, as was demonstrated by the preceding studies. In such a case, it would then be advisable to undertake a trend analysis and set a limit on the tolerable amount of change for a given period. The theoretical line of best fit for the amount of change (in composition as indicated by physical measurements) against per cent pack would probably be a warped ogive derived from a skew distribution function, since the distribution of daily change approaches the curve shown in Fig. 3. Thus the theoretical line of best fit would be similar to the curve given in Fig. 4.

In our particular applications, however, the line of best fit within the two sigma limits of change would be near enough a straight line to be used as such. Normal daily changes in density were found to have no significant effect on the per cent pack. This does not mean that density is an insignificant measurement, for that is not the case. It merely indicates that the density measurement records changes so small that they are nearly negligible as far as per cent pack is concerned when the operation is normal. Daily changes of one degree of softening temperature were found to have a definite effect on the per cent pack. These graphs are shown in Fig. 5 and Fig. 6.

In most applications of setting control limits, it would be best to use both methods of attack and determine whether or not changes would have to be made in the raw materials handling and mixing program before going too far in the development of the controls. These controls will enable an absolute evaluation of the materials handling program and will often point to areas for improvement.

It is, as always, absolutely necessary to establish the accuracy or efficiency of any program before installing a system of controls. As an aid in this direction, recorders should be installed at all crucial points in the mixing and

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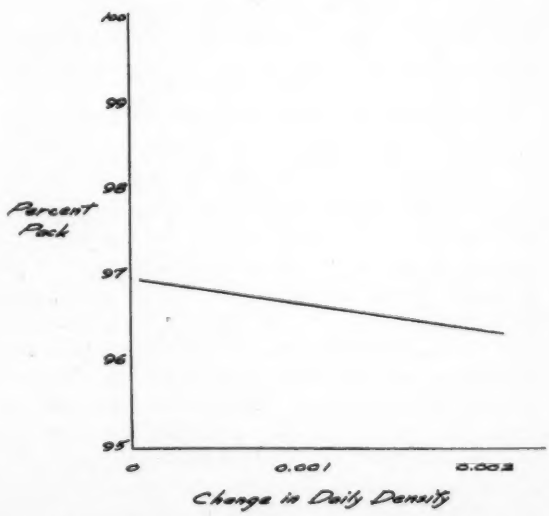

Fig. 5. Change in density versus per cent pack.

HOW TO REBUILD TANK FURNACES—SAFELY

By H. V. GARDNER, Safety Director
Glass Container Division, Owens-Illinois Glass Company, Toledo, Ohio

Every glass safety man will welcome this excellent article on one of the glass industry's most difficult safety problems.

Furnace rebuilds in glass plants are a headache for safety directors. They are the cause of unusual accidents, some of them severe—and near-accidents are common. The Glass Container Division of Owens-Illinois Glass Company has developed a safety training program for furnace rebuilds that has not only lowered accidents, but on occasions completely eliminated the serious ones.

The first hurdle is cleared when the supervisor in charge of the rebuild agrees enthusiastically and wholeheartedly to embark on a planned and proven training program. Such a program covers the items listed below. It is thought out and written down by the supervisor and the plant safety director well in advance of the actual rebuild. It is rigorously followed every day of the rebuild.

To set it in motion, the supervisor calls a preliminary meeting of all his foremen. The list of safe practices is discussed, changed as needed, and thoroughly grasped by each man.

Then a day or so before the rebuild begins, all the men who will be working on the job, both skilled and unskilled labor, meet together for the training session. The plant manager, as well as the department head, makes a point of being present. One by one the various points on the list are gone over. Local details are explained: *where* to get safety shoes and glasses; *where* the first-aid room is located; *what* to do in case of an emergency; and, of course, *who* the safety director and foreman are so the men will recognize them on the job.

Prescription safety glasses are supplied instead of plano glasses to those who need them.

In some plants much of the rebuild work is done by outside contractors. A special point is always made to get as many of these men at this meeting as possible. These outsiders must be familiarized with Owens-Illinois' safety policies, even though they are not on the company payroll.

Next step is daily follow-up of the program. As each new phase of construction is entered, the foreman holds an on-the-job session with his men, pointing out new hazards to guard against, safety equipment to wear, and other details. Such crew meetings are like the public utilities' "tail-board" conferences that have proved highly successful. In addition, every day the plant safety director tours the job to see that safety glasses actually are being worn and all other precautions followed. This daily follow-up is made easy by the preliminary training meeting. Without this the men would not know what they are supposed to do. In fact, they might not even know who the safety director is, or why he's talking to them.

This program is a natural—it has *produced results*. Serious accidents become a rarity. Safety glasses, safety shoes and hard hats really are used. And when an injury does occur, it gets prompt medical attention by trained personnel.

Here are the safe practices that are discussed at the training sessions, and followed during the days of construction:

Dismantling the Old Furnace

• Handling hot brick

Use gloves with special pad over gloves. Make sure no one is working directly under you.

• Holding chisel or bar

Grasp about half way, holding at angle shown you by striker.
Do not look at head of chisel.
Wear protective goggles.
Place feet so bar will not strike them if it flies out.
Do not talk to the striker.
Give striker notice before moving bar.
Have chisel, or bar sharp, and head in good condition.

• Using air hammer

Let hammer do the work. Riding it does little good and is hard on the operator.
Wear goggles.
Wear leather apron.
Keep tools sharp.
Stand with feet apart so when drill jumps it will not hit foot.
Make curious employees stand back.
Work as far from other people as possible.

• Striking chisel with hammer

Wear goggles.
Have firm footing.
Rest when arms are tired.
Keep firm grip on hammer.
Be sure hammer head is on tight and in good condition.
Be sure chisel head is not burred.

• Loading wheelbarrow

Don't load more than you can wheel.
Load in middle.
Balance your load.
Warn fellow workers it might tip over.
Don't sit on handles.

• Lifting

Use legs to help lift—saves your back.
Don't be a show-off and lift too much.
Get a buddy to help lift over 100 pounds.
Know where you are going with load before you lift it.
Don't carry a heavy load over loose bricks or boards.
Don't walk backward with load.
Don't jerk—lift gradually.

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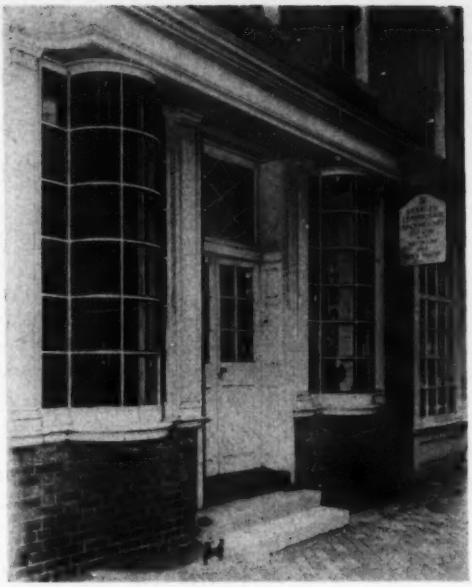
Reprinted from the National Safety Council News Letter, Glass and Ceramics Section.

GEORGE WASHINGTON SHOPPED HERE

By THE MAINS

Purcellville, Virginia



Entrance to the Stabler-Leadbeater Apothecary Shop in Alexandria. Famous for its "bow" windows, the shop is little changed from the days when it was patronized by General Washington, Robert E. Lee, and others.

Famous for its unique show windows and its fine collection of medicinal glass dating from colonial days, the Stabler-Leadbeater Apothecary Shop in Alexandria, Virginia—George Washington's home town—attracts thousands of visitors each year.

The unusual "bow" windows, each with its thirty small panes of glass, are beautifully curved in a manner reminiscent of the early shops of Old London. Through the many panes, light from three different angles is focused with dramatic effect on the symbol of pharmacy for centuries—handsome glass show globes filled with colored water.

This colonial apothecary shop, founded in 1792, has one of the finest collections of medicinal glass in America. Beneath the beautifully executed Gothic arcades, rows of well-worn shelves are filled with hundreds of hand-blown bottles. Many are gold-labeled with names of such early American remedies as "Wright's Indian Vegetable Pills" and "Rice's Worm Destroying Drops."

The flint glass bottles resemble our finest crystal of today. Although some historians claim that some of the glassware in the Stabler-Leadbeater Apothecary Shop may have been made by the New England Glass Company of Cambridge, Massachusetts, established in 1815, and the Boston and Sandwich Glass Company, established in 1825, positive identification has not been made.

Old, rounded showcase and ornate perfume cabinet display flint glass bottles and very old spectacles. On the extreme right can be seen the ancient symbol of the apothecary—a handsome glass jar of colored water displayed in one of the shop's bow windows. Gold-labeled bottles are displayed on shelves in the beautiful Gothic arcades.

Today this old drug shop may be seen almost exactly as it appeared when George Washington, Robert E. Lee, Daniel Webster, Henry Clay, John Calhoun, the Custis and Fairfax families, and other Northern Virginia patriots brought their shopping lists and engaged in "drug store conversations" while waiting for orders to be filled. The orders, accounts, and correspondence preserved in this shop constitute an almost priceless historical record. One documentary record bears the dateline, "Mount Vernon, April 22, 1802," and reads:

"Mrs. Washington desires Mr. Stabler will send by the bearer a quart bottle of his best Castor Oil and a bill for it."

Another from Judge Bushrod Washington, who inherited Mount Vernon from General Washington, reads:

"Respected Friend, Above is a check for 77.9 amount of your account, which ought much sooner to have been attended to. In future I will thank you to send it to me more frequently, at least once a year. Respectfully. Bush. Washington."

The store was founded by Edward Stabler whose descendants for nearly a century and a half continued the business in the same location. The business withstood the ravages of the War of 1812, the Yellow Fever Epidemic of 1821, and the War Between the States, 1861-65. On one occasion an army edict almost closed this famous shop.

The store was finally closed as an apothecary shop in 1933 when Dr. Stabler, the last of a long line of Stabler pharmacists, retired. It is now open to the public, ad-

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THE VALUE OF CORRECT LUBRICATION IN THE GLASS INDUSTRY

By BERILE B. STANDER, Research Chemist
E. W. Smith Chemical Company, Los Angeles, California

The proper application and choice of lubricants in the glass industry has become of major importance, particularly in high-speed production. As production demand increases, greater strain is placed on the machines, thus necessitating greater care in mold maintenance. The purpose of this article is to discuss some of these operations and offer suggestions that might be helpful to the industry at large.

In actual glass practice, a lubricant is used to promote and maintain a strong, protective film between the molten glass and the metal, a film that, regardless of temperature or pressure changes or of the chemical or physical composition of the glass, will permit a continuous flow of a finished and uniform product free from crazes or checks for as many operating hours as possible. Moreover, the lubricant should be so highly refined and compounded that it contains the least possible amount of impurities contributing to carbonaceous residue or corrosion.

Carbon Deposits

It is well-known to all of us that every known lubricant of a hydrocarbon or organic case contains carbon. Why? Because, carbon is a part of each of these lubricants. Therefore, it becomes the business of the chemist to discover a method by which carbon can be held to a minimum. Moreover, it should be the business of every glass engineer to choose a type of lubricant best designed and compounded to meet the highest specifications in purity.

As an example, the choice of a mold oil spray should be as low in carbon residue as possible; gravity and viscosity should be held to rigid uniformity. Also, the percentage of possible corrosive media must be held to a minimum. Recommended specifications for an oil of this type are as follows:

Gravity API @ 60°F.	27
Viscosity @ 100°F. SSU	100
Viscosity @ 130°F. SSU	64
Viscosity @ 210°F. SSU	39
Flash (C.O.C.) °F.	325
Fire (C.O.C.) °F.	355
Conradson Carbon Residue %	.005
Neutralization No.	.02
Pour ASTM °F.	—45
Color NPA	1—
Steam Emulsion No. Max.	50
Copper Discoloration	None
Sligh Oxidation	7-9
Dielectric Strength	35 KV

Dispersion Agents and Additives

Checking compounds, swabs, etc., should be compounded of refined stocks of uniform quality. The use of dispersion agents should definitely be confined only to those that have been thoroughly tested under actual conditions, to be assured of complete and uniform coverage. Many so-called dispersants or additives have been used in various oils and swabs. We have found that there is a place in the industry for some of these compounds if they are used according to their end application, as well as in the type of base in question. Too often agents of this type are not properly used in these finished products. Moreover, many are used that are highly damaging to the equipment. Many factors must be taken into consideration before these agents are to be used. It has been our experience to recommend only those dispersion agents that are positively compatible with the proper base, that produce a truly uniform and homogeneous finish, that promote positive suspension, and last, but certainly not least, complete and uniform coverage.

Other Impurities: Waxes, Gums, Residium

Regardless of the source, all lubricants contain varying degrees of impurities. These impurities vary according to the source of the raw material, its methods of manufacture, and last, but not least, the type of control employed in its manufacture. Most refiners of lubricants use very similar methods in their manufactured products. Moreover, many of these finished products must be sold at competitive prices. Under such circumstances, the manufacturer cannot afford the care and control necessary for a product required to meet specific needs such as those found in the glass industry. Consequently, a product may be offered to the industry that might be highly damaging to molds and other equipment. Thus, efficient operating hours are reduced, requiring shutdowns for cleaning and repairing. Just how many operating hours are lost due to poor lubricants is rather difficult to say. One must realize, however, that an inferior lubricant which has not been properly and correctly processed is responsible for this situation. Obviously, these products that are sold as specialized lubricants but in reality are only the "run of the mill" cracked lube stock, or other oils and greases not adapted to this type of work, cannot be expected to perform efficiently and economically.

The cause of replacements, cleaning, etc., is due chiefly to the result of the impurities in the lubricant, impurities that have not been removed through correct refining and chemical processing. As an example, hydrocarbon gums of many varieties, undesirable waxes, varnish forming sludge—yes, all of these and more exist in these various lubricants unless properly refined and processed. Quite naturally, heavy accumulations of carbon and scales are found on the equipment in a relatively short time.

Furfural Solvent Extraction

Solvent extraction processes have to a large extent revolutionized the refining of many stocks for correct chemical processing. Such extraction of properly selected stock with correct solvents represent the most

advanced step in the elimination and separation of the asphaltic and aromatic types of hydrocarbons from the more desirable naphthene component parts found in the lube fractions, thereby yielding a finished product of highly improved stability, free from sludge, gums and waxes.

As we have mentioned, solvent extraction processes depend, to a large extent, on the selective solvent action of certain types of organic liquids on the various types of hydrocarbons present in the lube stocks. Under normal circumstances, these solvents dissolve the aromatic type hydrocarbons which have less definite preference for naphthene hydrocarbons. Thus, solvent action affects a fractionation of raw stocks more or less on the basis of molecular structure. The extent to which preferential solvent action selects between these various types of hydrocarbon components depends almost entirely upon the solvent used, the ratio of solvent to the stock, extraction temperatures and the various designs of the extraction equipment, as well as the type of lube stock charge as to its proportions of paraffin, naphthene and aromatics, and the average size of the molecules.

One can easily see that such stocks having been thus treated are basically more adapted to chemical processing for use in the glass field.

Corrosion

The true definition of corrosion is, "The process of gradual disintegration, decomposition or destruction of metals due to chemical or electro-chemical action." This must not be confused with erosion, such as the grinding of iron into dust, etc., although many cases have been found where corrosion has, in a sense, been responsible for erosion, and vice versa. Insofar as the glass industry is concerned, we can interpret corrosion as, "those factors contributing to the decomposition or destruction of metal due to impurities found in lubricants." Unless properly controlled, these impurities, such as elemental sulphur, absorbed acid-forming gases, dissolved oxygen, etc., particularly when subjected to high temperatures and pressures, can become highly destructive. Again, we refer to the importance of careful control of chemical processing in order to avoid this possible damage.

The Effect of Mechanical Factors on Corrosion

Stress Corrosion. In the broadest sense of the word, stress corrosion is the result of stress on the surface—as an example, on mold surfaces. The stress may be internal or applied. Internal stresses are usually produced by non-uniform deformation during cold working, by unequal cooling from high temperature, and by internal structure re-arrangement involving volume changes. Generally speaking, these concealed stresses are of more importance than applied stress. Factors usually affecting stress cracking and corrosion are temperature, abrupt temperature changes, internal structure and environment.

Corrosion Fatigue. Defined, corrosion fatigue is generally accepted as, "the damaging effect of simultaneous action of cyclic stresses on metals." No metal is immune from some reduction of its resistance to cyclic stressing if corrosion exists due to the environment in which it is stressed or the decomposition of the impurities in the lubricant. The extreme reduction of resistance of certain metals to cyclic stress while exposed to a corrosive media is related to the type of pitting induced by such conditions. These pits are well-known to production department heads, particularly on molds. As corrosion proceeds under cyclic stressing, these pits become more pronounced and as corrosion fatigue continues, many of these pits develop into cracks, resulting in complete destruction of the equipment.

Fretting Corrosion. Defined, fretting corrosion is "the rapid corrosion that usually occurs at the interface by contacting high temperature metal surfaces which are subjected to high pressure and vibrations." This form of corrosion causes molds to be highly susceptible to fatigue failures, tends to destroy the dimensional accuracy of closely fitted molds and finally ruins mold surfaces.

Corrosion Fatigue Limits. The corrosion fatigue limit of a metal is defined as, "the maximum repeated stress that will not cause failure in a stated number of stress applications under defined conditions of corrosion and stressing." The value is significant only when conditions are completely defined, because if the metal is attacked by its environment or corrosive media, eventually it will be corroded completely and will possess no load carrying capacity whatsoever. Factors which have marked influence on corrosion fatigue limits are the nature of the corroding medium, nature and range of stress, rate of stressing, temperature, extreme change of temperature, degree of aeration, the corrosion resistance of the metal and physical properties of the metal, shock and vibration.

Research and actual plant tests are the only correct methods in determining the effectiveness of chemically controlled lubricants, and surely these operations make it possible to accept or reject ideas and changes that may assist in the further development of lubricants designed for greater effectiveness and economy.

DU PONT NAMES ELECTROCHEMICALS WEST COAST SALES MANAGER

The appointment of W. Roger Stoll, formerly connected with the sale of vinyl products, as West Coast Sales Manager for the Du Pont company's Electrochemicals Department has been announced by S. C. Harris, Director of Sales for the department. Mr. Stoll succeeds E. W. McGovern, who is being transferred to Wilmington company headquarters to become Manager of vinyl products sales.

Mr. Stoll has been in sales work with Du Pont ever since his graduation in 1934 from the University of California at Berkeley. As West Coast Manager, with headquarters at El Monte, California, he will be responsible for the sale of ceramic decorations, sodium, cyanides, peroxygen products, chlorinated solvents for metal degreasing and dry cleaning, refrigerants and furfural derivatives.

INCREASED EXPRESS RATES

It has been announced that the Interstate Commerce Commission has granted an interim increase to the Railway Express Agency on a 30-day statutory notice of six cents per shipment. This is strictly on an interim basis pending the Commission's decision on full evidence to be submitted by the Railway Express Agency at a later date.

SELECTING WEIGHING EQUIPMENT FOR THE GLASS BATCH HOUSE

By F. W. GILCHRIST, Chief Sales Engineer

Toledo Scale Company, Toledo, Ohio

In this age of modern miracles of design and production, we seldom find any general subject that is simple and well defined. "Weighing Equipment for the Batch House" most certainly falls in this category. Mute evidence of this would be a very brief survey of the weighing equipment that is being used. Probably we would find in use every type of scale that can be conceived by scale engineers, as well as a few that have been dreamed up by others. And why should there exist in an industry such as this, such a wide divergence of such important equipment?

There is one outstanding reason for this as we would suspect, as well as several minor ones. The big one is the extremely wide range of capacities that are required. Any industry is faced with this problem. In the glass industry it is particularly predominant. When we realize that the demand may run from one ton per day to several hundred tons per day, and further that this wide range will probably always be with us, then it becomes more reasonable to expect that there is and always will be a wide range of suitable and satisfactory equipment to handle such a problem.

If we can then agree that we are actually faced with this wide range of production, then perhaps we can discover some of the fundamental problems and what the answers might be. You will note that I said "if we can agree." This agreement must come on the subject of the general type of equipment that is most suitable and most practical for a certain production range. When we have agreed on this subject, then we can proceed with certain other important details.

No matter what sort of a system we do agree on, we must always keep foremost in our thinking the subject of accuracy. This would seem, at first glance, a most fundamental statement and certainly one that cannot be overlooked. Yet we are often faced with the problem of adapting a weighing system to a material handling system and finding it impossible to achieve satisfactory weighing accuracy.

Let us first decide what is normal scale accuracy. Generally speaking, the inherent accuracy of any type of scale is 1/10 of 1 per cent of its rated capacity. We should carefully note the two parts of this statement. We first mentioned the "inherent accuracy." This is the accuracy with which the scale will indicate true weight if it is allowed to weigh in its normal manner. More about this "normal" manner later. We next look at the last part of the statement—"its rated capacity." This is important because 1/10 of 1 per cent of rated capacity is important. For instance, suppose we have a scale rated at 1,000 lbs. 1/10 of 1% of 1,000# is 1#. This sort of accuracy is excellent for any kind of measuring, be it weighing or something else. However, we must remember that this scale will weigh accurately to 1 lb. Therefore, if we use this scale to weigh a 50 lb. load, we will still weigh to 1 lb. accuracy, but with respect to 50 lbs. our accuracy is 2% not 1/10 of 1%. This particular phase of accuracy cannot be over-emphasized and the subject will keep coming up in this discussion.

In the small production batch house, operation is, and must of necessity continue to be, essentially a manual operation. That is, the materials are collected and weighed by hand. In an operation of this kind we must recognize that there is a human element involved and, as such, is subject to error. Therefore, the important steps in even such a simple system must be easy, free from interference, simple in sequence, and done with adequate and accurate equipment. If a central weighing point is used, the scale equipment should be chosen for the job to be done. If a single scale is used for the larger materials, it should be only of sufficient capacity to handle the weight of the heaviest material. The materials on this scale should then be weighed separately and not accumulatively. This will make for maximum possible accuracy provided the operator does his work as directed. The scale itself should be of the type that can be read directly with no manipulation of loose weights or calculations by the operator. The scale should be illuminated for ease of reading. It should be located convenient to the operator so that he can read it accurately and without any other interference.

As a check on the actual operation, it is often found effective to prepare a batch card on which are preprinted the material names and the material batch weights. A separate card is then issued for each batch to be made. The scale is equipped with a weight printing device and a material identifying device. Then as each material is weighed the card is inserted in the printer, the identifier properly set, and then a permanent record made of batch by pressing a button. Of course, it is impossible to say that such a scheme is foolproof, but if it is rigidly insisted upon, it does continuously remind the operator of the importance of his job.

In the design of such a manually operated system, one point is generally overlooked. If a mistake is made by the operator, especially if he weighs out too much of a given ingredient, a convenient method of correcting the error must be provided. If it is too difficult, or even inconvenient at all, he will be inclined to overlook it and even go so far as to fake a record if used. It is extremely unusual in any manually operated system, be it in the glass industry or any other industry, where any thought has been given to this feature of the equipment, and yet it is a small refinement that can well add immeasurably to the batch weight accuracies.

In this small production system, the small ingredients, the decolorizers, should be weighed on a small scale chosen for its capacity, readability, and ease of operation exactly the same as was done for the scale for the large materials.

In both of these scales, proper maintenance must be present. Especially is this important since these scales

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are usually subject to rather dusty operating conditions and cannot long maintain their accuracy unless they are properly taken care of. This maintenance work should be done by a reputable trained scale mechanic on a prescribed time schedule. A scale is a precision instrument and should be treated as such.

As the production demands on the batch house increase, it soon becomes apparent that the full manual system is no longer adequate. The evolution, shall we call it, of the batch house of higher capacity has followed a very definite pattern. Higher capacities required larger storage bins. The first attempt for improved operation was to move the mixer and scale to the materials. This was done by mounting the mixer on the scale and in turn mounting the two on wheels. The whole apparatus was then moved to the bins. Probably at the time this system looked good. But it was soon apparent that a scale was never intended for such service. The mixer was taken off of the car and permanently mounted at the end of the run. This was an improvement but considerably more progress was possible, although the scale performed better than before it was still not a desirable operation. The next step was to install suspended type hopper scales at each of the silos. Each scale was chosen to handle just that material and therefore was able to deliver maximum possible accuracy.

This multiple scale arrangement was ideal as far as the scales were concerned, but it still left complete control in the hands of the operator.

With the next step we find ourselves in what might be termed the "modern era" in which practically all of the principal objections of the older systems have been overcome. Namely: the weighing by the operator has been completely eliminated and the batch house has become a good place in which to work since it can now be dust-free and clean.

As one might suspect, the weighing and material handling equipment in the modern batch house has taken many different forms as a result of many peculiar local problems and conditions. Generally, however, the important phase has been the elimination of the human element as well as the use of properly designed equipment. The result—increased batch accuracy and consistency with all of the attendant benefits thus achieved.

The number of scales that are used on the larger materials is very often determined by the physical arrangement of the storage silos. For maximum accuracy of batch weights a separate scale for each material is necessary. When this is done, each scale can be of such a capacity as demanded by that material. The scale can then be used at or near its rated capacity. As stated before, under these conditions the scale will then give maximum accuracy. With some bin arrangements, it is difficult to obtain these optimum conditions. Fewer scales are used. The resultant reduction in accuracy must be accepted.

When one scale is used to weigh several materials, it must be done accumulatively. That is, one material is weighed, then another is weighed on top of the first, and so on. Thus the scale capacity must be at least equal to the total weight of the materials being weighed on that scale. As a result, the accuracy on the individual weights is drastically reduced as we have pointed out before.

In addition to this reduced accuracy due to accumulative weighing, there also exists another condition that must be accepted. This can be called accumulative errors. If the first material, for instance, should be over-weight and not corrected, then the second material will be under-weighed by the same amount. Similarly the second material may be under-weighed on the same batch. Then we have a double or accumulated error on the second material. This is a condition that can only be corrected by very elaborate and complicated apparatus not usually recommended for this type of installation. These two conditions are there when accumulative weighing is employed and they must be accepted as inherent with this type of system.

To eliminate the human element in the weighing part of the batching cycle requires certain additional pieces of material handling equipment and certain attachments to the scale.

There is required a power operated feeding device to convey material from the storage bin to the scale weigh hopper. This feeding device should deliver material at a fairly uniform rate. It should be capable of running at a fast rate and be able to be shifted to a slow rate at least one-third that of the fast rate. It should stop quickly when the power is removed. If a power operated feeder is used to unload the weigh hopper, it should have the same characteristics as the weigh feeder.

The scale should be equipped with two control points: one to control the weigh feeder and one to check the empty hopper or to control the discharge feeder. The first control point should be adjustable so it is a simple and efficient operation to alter the batch weight. These control points should be as accurate in their operation as the inherent accuracy of the scale and they should in no way affect or interfere with the weighing of the scale. They should be capable of controlling the weigh feeder at fast and slow feeds so that in operation the feeder can be slowed down to a slow or dribble feed just before the batch weight is reached and then stopped when the exact weight is reached.

As we have noted, the control point is as accurate as the scale. Therefore, the accuracy of the batch itself depends on other factors.

In order to achieve accurate batch weights, the performance of the feeding device must be controllable and predictable for the following reasons. The control point on the scale must be set ahead of the actual batch weight in order to compensate for the amount of material in suspension between the discharge end of the feeding device and the level of material in the weigh hopper at the time of cut-off. Therefore, it is essential that this control point be so designed that this adjustment can be made in the field.

Slowing the weigh feeder to a dribble feed just before the final cut-off has two important effects. First, it overcomes a possible error if weighing is done at a rather high speed. Under these high speeds it is possible that the scale indicating system is being affected by both the impact of the falling as well as the addition of material and, therefore, is not accurately indicating the true addition of weight. Obviously, it is absolutely necessary that the scale indicate true weight at the time of final cut-off. Slowing the feeder down allows the scale to indicate true weight.

The second effect of the dribble feed is to reduce the

amount of material in suspension and, therefore, increase the possible accuracy.

We can sum up this subject by stating that the batch weight accuracy in a properly designed scale system equipped with an efficient cut-off will be determined entirely by the consistency of the amount of material in suspension at the time of cut-off. Thus, the selection of weighing equipment not only includes careful consideration of the scale itself and the scale control points, but just as important, the feeding device.

We have not quite covered all of the factors that influence batch weight accuracy. Earlier we mentioned that in a modern system it is possible to achieve a clean and dust-free batch house. This is done by using fully enclosed feeding devices, fully enclosed weigh hoppers and a fully enclosed weighed batch pick-up conveyor. All of these separate units must be joined by flexible dust-tight connections. Applying a flexible connection to a weigh hopper requires careful design, careful installation and regular maintenance. Improper procedure with any of these phases can easily introduce errors that can be serious and can destroy the effectiveness of an accurate scale and accurate control points.

Since it is possible that flexible connections can introduce undesirable errors, it is obvious that the number of these connections should be kept to a minimum. This is one of the inherent (and difficult to overcome) objections to a system where several materials are handled on one scale.

One phase of this subject of flexible connections that must be emphasized is the maintenance of these connections. They must be kept in good condition. Good scale maintenance will keep a good check on whether or not they are affecting scale accuracy.

In a fully automatic system, the control of loading and unloading the mixer is also taken away from the operator and incorporated integrally with the scale control system. With an over-all system such as this, there are certain protective and interlocking features that have been found to be absolutely essential: First, any step in the cycle cannot start unless the previous step has been completed. Second, any mechanical or electrical failure must stop the cycle at the point of failure. Third, in the event of an emergency stoppage or an electrical power failure, the electrical system must be designed so that upon restarting, the cycle will be resumed exactly at the same step at which it was interrupted. Fourth, indicating pilot lights should be provided to show each important step in the cycle. Fifth, the scales should be of a type that will indicate at all times the condition of the weigh hopper, how accurately the cut-off is operating, how accurately the scale is unloading and whether or not the batch is being weighed or discharged.

Any well-engineered automatic system should provide for emergency manual operation. It has been our experience that this feature should include several important features. There should be a key-operated master Manual-Automatic switch so that manual operation can only start with the approval of supervision. Manual operation should be inconvenient so that the operating personnel will demand that automatic operation be resumed as soon as possible. Manual operation should by-pass all interlocking.

In conclusion let me describe two examples of what good batch weight control can mean to the glass plant operator. In one installation with the old manual operation, it was found necessary that a different batch formula be used for each of two furnaces although both were making the same kind of glass. After installing a fully automatic system that was designed so that two formulae could be handled at will, it was soon discovered that both furnaces required the same formula.

In another installation it was felt that the flexibility of changing the formula of the decolorizers was of prime importance since with a manual system it was absolutely necessary. After operating with the automatic system for a period of time, it was found that the requirements for a decolorizer were very similar to all of the other materials and did not require rapid and large changes.

So, with a carefully designed weighing system, carefully installed and properly maintained batch formula can be obtained both accurately and consistently. Nothing more can be desired.

L-O-F SALES CHANGES

G. P. MacNichol, Jr., Vice President in charge of Sales of Libbey-Owens-Ford Glass Company, has announced several changes in the company's sales department. J. M. Johns, General Manager of industrial sales, has been appointed General Manager of the new L-O-F Fiber-Glass Division, succeeding Robert E. Worden, who served as General Manager of the Division in its development stage.

E. M. Everhard, General Manager of L-O-F- distributor sales since 1942, has been named to the newly-created post of General Sales Manager, where he will have charge of both distributor and industrial sales. E. C. Walbridge, Manager of the company's window glass sales, will succeed Mr. Everhard, and A. P. Plant will succeed Mr. Johns as General Manager of industrial sales.

The firm has also announced the establishment of a district sales office in New York City by the Fiber Glass Division which will be in charge of Arnold K. McClay, who, for the last three years, has been connected with L-O-F glass sales in that city.

Mr. McClay will have his offices at 570 Lexington Avenue and from that headquarters will handle fiber glass sales in the New England states, New York, Pennsylvania, New Jersey, Delaware, and Maryland.

INNIS, SPEIDEN HOLDS EASTERN DIVISION SALES MEETING

The Eastern Division Sales meeting was held in the New York office of Innis, Speiden & Company, at which time all department managers and all sales personnel from New York, Boston, Philadelphia and Gloversville attended.

A review of 1951 operations was given by Donald S. Cushman, Vice President, as were plans and estimates for 1952. Various department managers had an opportunity to explain new products, which will be announced, new sales connections and new manufacturing operations.

A siimlar meeting was held in Chicago for the Midwestern Sales Division, including the Chicago, Cleveland and Cincinnati branches.

Inventions and Inventors

Feeding and Forming

Glass Mixing Apparatus. Fig. 1. Patent No. 2,577,213. Filed May 14, 1945. Issued Dec. 4, 1951. One sheet of drawings. Assigned to Owens-Corning Fiberglas Corporation by Games Slayter and Ed Fletcher.

This invention provides a mixing apparatus for treating the glass prior to any forming operation in order to obtain greater uniformity or homogeneity of the glass and the resulting product. It is particularly useful in the manufacture of glass fibers.

The molten glass is delivered from a feeder 10 after passing a screen 18 in a stream 12 to a rectangular container 13 which is reciprocated by an eccentric 19. After passing a screen 20 the glass flows to a bushing 15 and from there to a device 17 which forms the glass into marbles to be used in making fibers or to some other forming device.

The patent contains 10 claims and references cited were 930.086, Reed, Aug. 3, 1909; 1,618,290, La France, Feb. 22, 1927; 1,954,732, Gossler, Apr. 10, 1934; 1,986,575, Honiss, Jan. 1, 1935; 2,061,333, Skinner, Nov. 17, 1936; 2,159,361, Atkinson et al., May 23, 1939; 2,411,031, Deyrup, Nov. 12, 1946; 449,233, Germany, Sept. 7, 1927; and 612,120, France, July 24, 1926.

Forehearth Cooling. Fig. 2. Patent No. 2,582,477. Filed Apr. 19, 1950. Issued Jan. 15, 1952. One sheet of drawings. Assigned to Emhart Manufacturing Company by M. M. Cannon, Jr.

The channel of the forehearth is of the usual construction being made up of refractory channel blocks, one of which is shown at 12. These are enclosed by insulating material 17 and an outside metallic casing 19. The section shown in the figure is taken at one of the joints between the channel blocks 12 and, therefore, is not crosshatched. The insulating material 17 does not cover the joint between adjacent channel blocks, thus leaving a narrow open channel 19. The upper ends of this U-shaped channel are open to the atmosphere at 20 and air is admitted at the bottom by an opening 21. This provides a circulation of cooling air around the joint between channel blocks and cools the molten glass enough to prevent it from leaking through the joint as might otherwise happen.

The patent contains two claims and the references cited were 261,054, Siemens, July 11, 1882; 1,512,566, Tucker et al., Oct. 21, 1924; 2,162,983, Sullivan, June 20, 1939; and 2,174,458, Blau et al., Sept. 26, 1939.

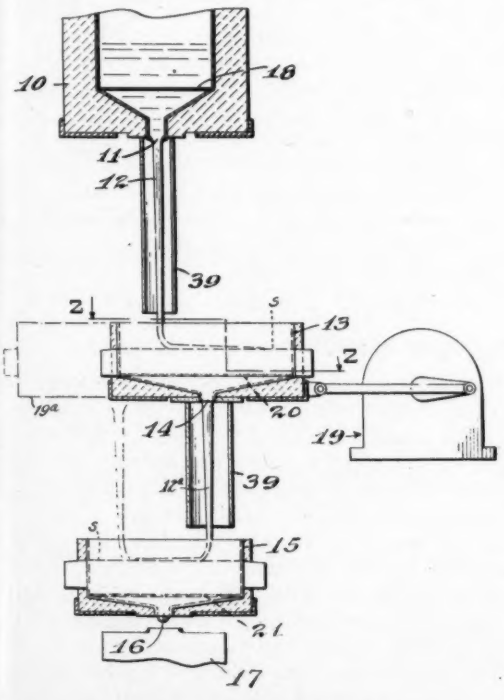


Fig. 1. Glass Mixing Apparatus.

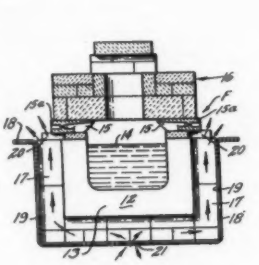


Fig. 2. Forehearth Cooling.

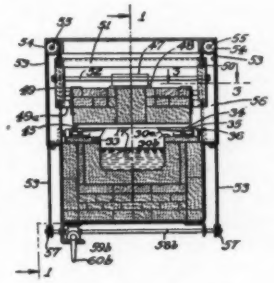


Fig. 3. Forehearth.

Forehearth. Fig. 3. Patent No. 2,583,629. Filed Jan. 29, 1947. Issued Jan. 29, 1952. One sheet of drawings. Assigned to Emhart Manufacturing Company by M. M. Cannon.

This is an improvement over the forehearths shown in Patents No. 2,139,911 and 2,144,973. The cooling section is covered by a refractory plate having vertical vents which may be closed by bricks 47. Two cranks, such as 60b, are provided at each end of this cover plate. By means of a clutch, the ends of the cover plate may be adjusted vertically either simultaneously or independently. This greatly improves the control of the cooling operation.

The patent contains two claims and ten references.

Single Mold Forming Machine. Fig. 4. Patent No. 2,584,524. Filed Jan. 10, 1946, in Switzerland Jan. 17, 1945. Issued Feb. 5, 1952. Seven sheets of drawings. Alphons Wyss, Bottmingen, Switzerland, inventor.

This is a single-mold suction machine in which the mold 1 is projected toward a pool of glass and lowered into contact with the surface, raised, retracted, the suction mold opened, and the parison lowered into the blow mold 2 where the bottle is blown. As is usual with machines of this type, the whole machine may be moved easily into working position with the tank. The operating parts are greatly simplified and adjustments may be made very easily.

The patent contains 11 claims and 13 references were cited.

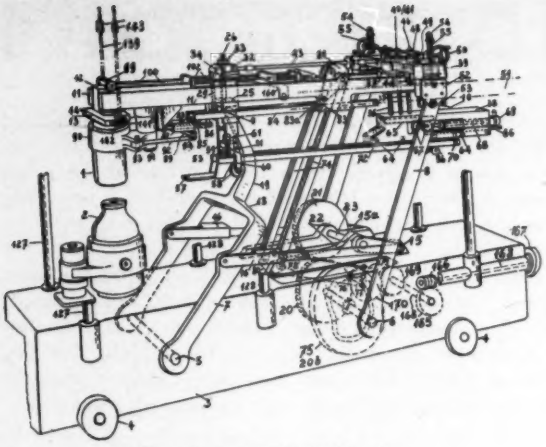


Fig. 4. Single Mold Machine.

Glass Compositions

Ultraviolet Absorbing Glass. Patent No. 2,582,453. Filed July 2, 1948. Issued Jan. 15, 1952. Three sheets of drawings, none reproduced. Assigned to American Optical Company by Alexis G. Pincus.

This glass is intended for use particularly in the manufacture of lenses, filters and other light transmitting mediums. It is of a controlled color and has less than 1% ultraviolet transmission up to 365 millimicrons in the ultraviolet region of the spectrum with at least 75% transmission in the visible region of the spectrum, and the method of producing such improved absorbing glass.

One table found in the patent gives an analysis of such a glass as follows:

Ingredients	Specific Example, Parts by Weight	Range, Parts by Weight
Silica (SiO_2)	70.4	67-70
Soda (Na_2O)	8.7	0-17
Potash (K_2O)	8.2	0-17
Lime (CaO)	10.5	9-14
Chlorine (Cl_2)	0.6	0-2
Sulphur Trioxide (SO_3)	0.6	0-1.5
Vanadium Pentoxide (V_2O_5)	0.8	0.2.-1.2
Manganese Dioxide (MnO_2)	0.2	0.15-0.45

The patent contains numerous tables and a full description of the characteristics of the new glass.

The patent contains 21 claims and the references cited were 1,292,148, Taylor, Jan. 21, 1919; and Morey: Properties of Glass (1938), page 101.

Optical Glass. Patent No. 2,584,974. Filed May 13, 1948. Issued Feb. 12, 1952. No drawings. Assigned to Corning Glass Works by William H. Armistead.

This patent contains a table giving nine examples of compositions in per cent by weight as calculated from their batches. The first five of these examples are as follows and they are especially valuable in anomalous achromat systems:

	I	II	III	IV	V
SiO_2	15	15	20	20	15
B_2O_3	15	15	20	20	15
La_2O_3	20	20	30	30	20
BeO	5	5	5	5	5
CaO	20	20	20	20	20
BaO	20	..	..	..	10
CdO	..	20	..	..	10
SrO	..	..	..	..	..
PbO	..	..	..	..	..
ZrO_2	5	5	5	..	5
ThO_2	..	..	..	5	..
RO	45	45	25	25	45
$RO+La_2O_3$	65	65	55	55	65
nD	1.700	1.726	1.687	1.681	1.713
v	51.6	47.8	53.8	55.3	49.7

The patent has ten claims and the references were 2,297,453, Berger et al., Sept. 29, 1942; and 2,406,580, Bastick et al., Aug. 27, 1946.

Optical Glass Patent No. 2,584,975. Filed March 27, 1951. Issued Feb. 12, 1952. No drawings. A continuation-in-part of the preceding patent.

The first five of the ten examples given in this patent corresponding to those reproduced above, are:

	I	II	III	IV	V
SiO_2	15	15	15	15	15
B_2O_3	15	15	15	15	15
La_2O_3	10	20	20	20	20
BeO	5	5	5	5	5
CaO	20	20	20	20	20
BaO	20	..	..	10	10
ZnO	..	10	..	10	..
CdO	..	10	20	..	10
SrO	..	..	..	..	..
PbO	10	..	..	..	..
ZrO_2	5	5	5	5	5
nD	1.702	1.723	1.726	1.710	1.713
v	45.9	47.7	47.8	49.6	49.7

The patent contains 15 claims and no references were cited.

Glass Wool and Fiber

Fiber Making Apparatus. Patent No. 2,582,561. Filed Sept. 21, 1945. Issued Jan. 15, 1952. Two sheets of drawings, none reproduced. Inventor, Ivan Peyches, Paris, France, assignor to Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey, Paris, France.

On account of the French filing date, this patent expires June 4, 1963. The machine comprises a high-speed rotating mechanism from which the molten glass is discharged by centrifugal force and drawn out by compressed air directed in a particular manner.

The patent contains four claims and the references cited were 1,289,779, Howard, Dec. 31, 1918; 2,257,767, Slayter et al., Oct. 7, 1941; 2,315,735, Richardson Apr. 6,

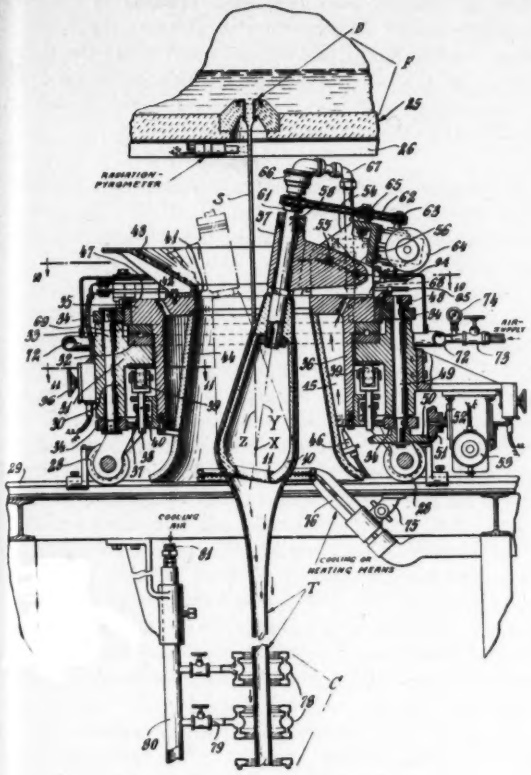


Fig. 5. Tube Forming Machine.

1943; 2,333,218, Von Pazsiczky, Nov. 2, 1943; and 571,807, Germany, Feb. 16, 1933.

Tube and Cane Machines

Tube Forming Machine. Fig. 5. Patent No. 2,583,431. Filed Feb. 12, 1942. Issued Jan. 22, 1952. Four sheets of drawings. Assigned to Westinghouse Electric Corporation by A. H. Laidig and H. K. Richardson.

This machine is for making tube or cane and it is distinguished particularly by the construction and movement of the mandrel onto which the glass flows and from which it is drawn as a tube or cane. The figure is, to a large extent, self-explanatory. The stream of glass falls onto a circular mandrel having an opening in the lower end and connections to supply air to the inside. The mandrel rotates about its axis and also has a planetary motion around a circular track as indicated by the full and dotted line positions.

The patent gives the preferred dimensions of the parts and examples of glass compositions suitable for use. A modified form of the invention is shown.

The patent contains 14 claims and 16 references were cited.

Miscellaneous Processes

Ware Testing Device. Fig. 6. Patent No. 2,578,573. Filed Aug. 15, 1946. Issued Dec. 11, 1951. Six sheets of drawings. Assigned to Hires, Castner & Harris, Inc., by John Mills.

This is a device for the purpose of detecting projections from the bottom of pressed and blown ware where there sometimes occurs what is known as "Spikes" caused by the molten glass sticking to the plunger during the pressing operation. A turret presents the ware to a testing station where it is raised so that a head 166 goes toward the bottom of the ware. If there is a normal flat bottom, the head goes to the full length of the ware, but if a spike 236 or other protuberance encounters the head before the full stroke of the ware, an ejector mechanism is thrown into operation to discharge the defective jar.

The patent contains three claims and the references were 1,769,039, Sague, July 1, 1930; 1,905,099, Jay, Apr. 25, 1933; 2,383,297, Dorothea, Aug. 21, 1945; 2,385,882, Rolker, Oct. 2, 1915; 2,407,062, Darrah, Sept. 5, 1946; 262,272, Germany, July 9, 1913; and 304,652, Germany, Mar. 25, 1918.

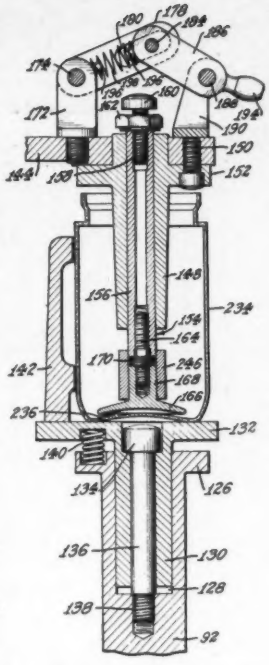


Fig. 6. Ware Testing Device

Glass-to-Metal Seal. Fig. 7. Patent No. 2,579,222. Filed Aug. 3, 1950. Issued Dec. 18, 1951. Two sheets of drawings. Assigned to Remington Rand Inc., by Marshall P. Wilder.

This is a method of sealing rectangular face plates to metal television tubes. The metal cone 10 is mounted on a block 11 and the upper end of the cone is surrounded by an induction coil 12. A vertically movable rod 15 has three or more levers 20 which support the glass plate 22 in position to be lowered into place on the cone. The plate is evenly preheated by a burner 23. The edge of the plate is surrounded by a series of insulated burner nozzles 25.

After the plate has been heated by the burner 23, the

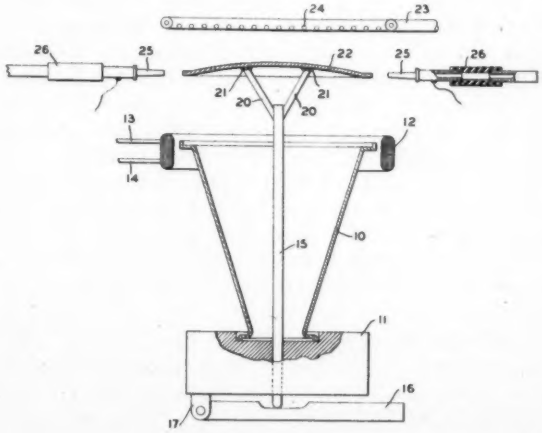


Fig. 7. Glass-to-Metal Seal.

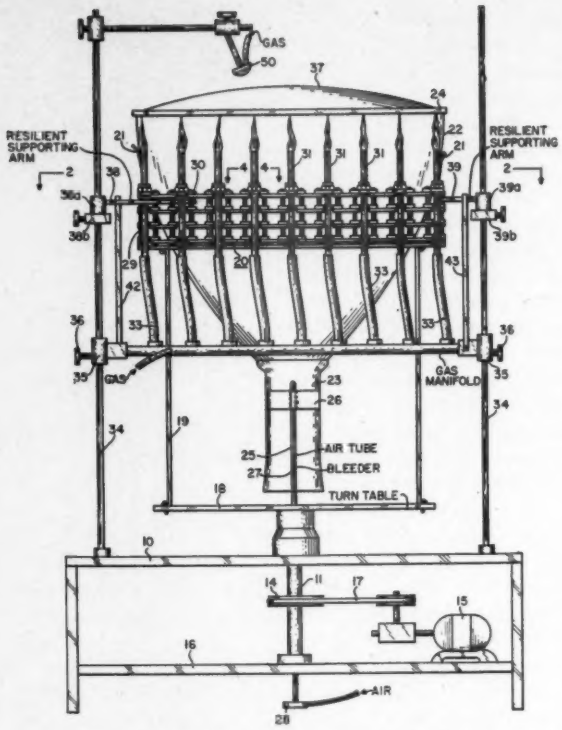


Fig. 8. Cathode-ray Tube Sealing Machine.

burners 25 are lighted and radio frequency power is turned on successively through these burners. When the edge of the plate has been heated to a sealing temperature, the support of the plate 22 is lowered so that it engages the cone 10 and a seal is made.

The patent contains three claims and the references cited were 2,296,307, Power, Sept. 22, 1942; 2,306,054, Guyer (I), Dec. 22, 1942; 2,383,113, Dailey, Aug. 21, 1945; 2,428,969, Guyer (II), Oct. 14, 1947; 2,445,063, Guyer (III), July 13, 1948; and 2,462,205, Machlett et al., Feb. 22, 1949.

Cathode-ray Tube Sealing Machine. Fig. 8. Patent No. 2,580,450. Filed Dec. 5, 1950. Issued Jan. 1, 1952. Two sheets of drawings. Assigned to The Rauland Corporation by W. P. Melcher and H. H. Voelz.

The flanged cone 22 is supported by brackets 21 and the face plate 37 is placed in position on the flange of the cone. A series of burners 31 is carried by a flexible chain 28, each burner being supplied with gas by a rubber tube 33. The cone is rotated by the motor 15 and the burners are controlled so that they follow the contour of the cone, this being permitted by the chain 28. Compressed air is admitted to the inside of the cone by the pipe 25 to prevent the viewing plate from deforming. The plate may be heated if desired by the burner 50.

The patent contains three claims and no references were cited by the Patent Office.

Tube Cutting Apparatus. Patent No. 2,582,078. Filed Jan. 30, 1951. Issued Jan. 8, 1952. One sheet of drawings, none reproduced. Thorsten Solum and H. C. Franson, inventors.

This is a jig having two holes to accommodate glass tubes of different sizes. A radial opening to each hole provides means for inserting a glass cutter which is pressed against the tube by one hand while the tube is turned by the other. This gives a clean square break.

The patent contains two claims and no references were cited by the Patent Office.

Jar Inspecting Machine. Fig. 9. Patent No. 2,582,494. Filed Aug. 1, 1946. Issued Jan. 15, 1952. Three sheets of drawings. Assigned to Emhart Manufacturing Company by Edward H. Lorenz.

This is a turret type machine having a loading station L, a station S at which a feeler moves inside toward the bottom of the jar, an inspection station I, a reject station R where defective jars are ejected, and a delivery station D where the good ware passes out. At station I, a beam of light from a source 16 is directed onto the finish of the jar and if there is a check encountered, the light will be reflected to a photoelectric cell 17 which throws an ejecting mechanism into operation.

At station S a photoelectric cell 121 detects whether or not the feeler has passed to the normal bottom of the jar or has been stopped at a higher position by a spike on the bottom. The ejecting mechanism will be rendered operative if the feeler does not make its full stroke. When the ware reaches station R, defective ware will be ejected if the ejecting mechanism has been rendered operative. Good ware will pass out at station D.

The patent contains five claims and the references cited were 1,586,155, Keller, May 25, 1926; 1,756,785, Gallasch, Apr. 29, 1930; 2,318,856, Hoffman, May 11, 1943; 2,338,868, Owens, Jan. 11, 1944; 2,353,758, Peck, July 18, 1944; 2,407,062, Darrah, Sept. 3, 1946; 2,410,093, Martinec, Oct. 29, 1946; and 304,652, Germany, Mar. 25, 1918.

Ampul Machine. Patent No. 2,582,818. Filed April 13, 1948. Issued Jan. 15, 1952. Three sheets of drawings, none reproduced. Assigned to United Products Co., Inc., by George Coby.

This is a turret type machine for making ampuls from glass tubing and it is said to be an improvement over what is shown in Patent No. 1,962,985. The steps involved include cutting a section from the tube by a

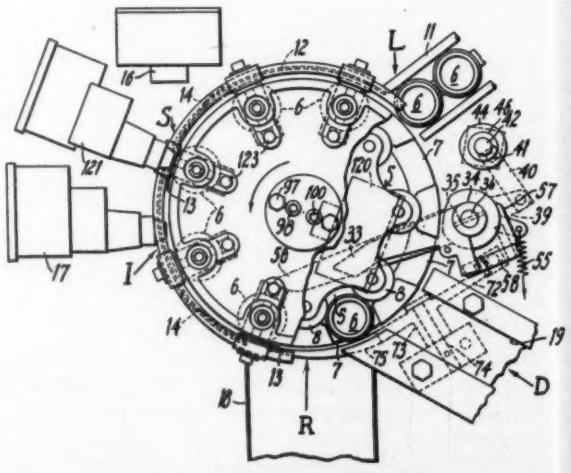


Fig. 9. Jar Inspecting Machine.

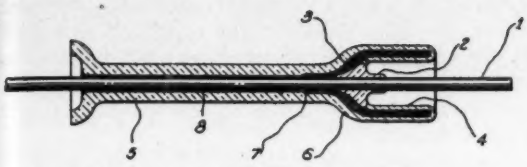


Fig. 10. Seal for High Pressure Lamps.

flame, moving the severed portion away from the tube and out of line with it so as to form a sealing film across the top of the ampul, heating the ampul to expand the enclosed air and to blow an opening through the film and then moving the ampul back into line with and toward the tube so as to form a thickened edge on the ampul.

The patent contains four claims and the references cited were 1,962,985, Dichter, June 12, 1934; and Ser. No. 418,604, Dichter (A. P. C.), published April 27, 1943.

Cellular Glass. Patent No. 2,582,852. Filed Jan. 16, 1948. Issued Jan. 15, 1952. No drawings. Assigned to Pittsburgh Corning Corporation by M. J. Shoemaker.

The patent contains eleven claims and the invention is defined in claim 9 as: a process of preparing light colored cellulated glass, comprising the steps of, providing an intimate mixture of pulverulent glass and carbon in which the metal components of the glass, expressed as oxides, are within the following ranges in percentages by weight:

Oxide	Per cent
SiO_2	50-80
Al_2O_3	0-10
CaO, MgO	0-20
Na_2O, K_2O	2-15
B_2O_3	0-15
Fe_2O_3	3-15

in which some of the components, calcium oxide, magnesium oxide, and boron trioxide are within a percentage range of 5 to 40%, and the carbon is within 0.17% to 5% by weight of the glass, heating the mixture in a non-oxidizing atmosphere to a temperature of about 1500°F. To soften the glass into a coherent mass, raising the temperature to about 1700°F. to cellulate the mass, and then annealing the product.

The references cited were 130,578, Hartman, Aug. 20, 1872; 2,123,536, Long, July 12, 1938; 2,257,681, Haux, Sept. 30, 1941; 2,337,672, Long, Dec. 28, 1943; and 2,401,582, Owen, June 4, 1946.

Seal for High-Pressure Lamps. Fig. 10. Patent No. 2,583,388. Filed Sept. 14, 1948. Issued Jan. 22, 1952. Assigned to General Electric Company by E. H. Nelson and E. B. Power, both of Kenton, England. Filed in Great Britain May 1, 1947.

This seal comprises a metal conductor 1 having a button 3 sealed by an intermediate piece of quartz 4 to the end of the quartz tube 5. A thin molybdenum sheet 8 is wrapped around a part of the conductor 1 as shown. Powdered silica 7 fills the vacant space around the tube and the tube is then heated and collapsed while vacuum is applied to the inside. A second form of the invention is shown.

The patent contains one claim and 11 references were cited.

Sealing Electric Discharge Lamps. Patent No. 2,583,525. Filed originally Apr. 17, 1943. Divided and this application filed Aug. 15, 1946. Issued Jan. 22, 1952. Two sheets of drawings, none reproduced. Assigned to General Electric Company by Joe Yoder.

The original patent on this application was issued as Patent No. 2,535,773. The patent claims the method of sealing the ends of a tubular fluorescent lamp, the inside of which is completely coated with fluorescent material, by providing an end piece and sealing the parts together by a particular forming process while the adjacent parts are softened by burners.

The patent contains two claims and the references cited were 1,461,155, Madden et al., July 10, 1923; 1,842,184, Madden, Jan. 19, 1932; 2,349,822, Gardner May 30, 1944; and 108,574, Austria, Jan. 10, 1928.

Sealing Glass to Metal. Patent No. 2,584,354. Filed Jan. 11, 1951. Issued Feb. 5, 1952. One sheet of drawings, none reproduced. Assigned to Radio Corporation of America by R. W. Kissinger and R. D. Faulkner.

This patent contains seven claims and the invention is defined in Claim 1 as a method of providing a relatively large area surface of a metal body with a glass facing comprising cleaning said surface, providing said cleaned surface with an oxide coating, outgassing said coated surface, placing against said surface the convex surface of a glass plate of arcuate cross-section, and heating both said body and said plate to the softening temperature of said glass until said plate reclines to the contours of said surface and becomes sealed thereto.

No references were cited by the Patent Office.

Method of Cutting Glass. Patent No. 2,584,851. Filed May 23, 1946. Issued Feb. 5, 1952. One sheet of drawings, none reproduced. Assigned to Libbey-Owens-Ford Glass Company by Donald W. Dunipace.

This patent shows a method of cutting thick glass, perhaps around 1¼" thick, which has been quite difficult heretofore. This is done by heating the glass electrically along the path of the cut but instead of heating a continuous line, only intermittent sections are heated leaving unheated sections between. The patent gives directions as to the length of these heated and cool sections, electric power required and so forth. A much better cut may be obtained by this method.

The patent contains nine claims and references cited were 1,289,510, Miller, Dec. 31, 1918; 2,022,466, Hess, Nov. 26, 1935; 2,116,129, Stringer May 3, 1938; 2,125,922, Hopfield, Aug. 9, 1938; 2,169,687, Fowler et al., Aug. 15, 1939; 2,247,118, Drake, June 24, 1941; 2,258,692, Turke, Oct. 14, 1941; 2,282,440, Turke, May 12, 1942; 17,776, Norway, Oct. 30, 1907.

• Selas Corporation of America has announced the opening of a Pittsburgh office at 3829 Willow Avenue.

SOME HIGHLIGHTS OF MEXICAN GLASS PRODUCTION

The Mexican glass industry is faced with serious problems, both in obtaining supplies of prime materials as well as in sales. Though Mexico is an important producer of copper, selenium is not manufactured in the country and must be imported. Since the copper derivative has been classed as an essential war material, restrictions have been imposed on its export and glass manufacturers in Mexico have been badly hit as a result.

Manufacturers of glass products there have made strong petitions to the government that copper producers should be ordered to produce supplies of selenium sufficient for the needs of the industry. However, until now, these efforts have met with failure and there is not sufficient selenium available to cover the needs of the glass industry.

Soda ash, another prime material, is also in very short supply. A plant did start production of this essential product in the Valley of Mexico, but technical production difficulties arose and forced shut-down of the plant. Soda ash has been imported from England exclusively but, as import is restricted (permission to import must be obtained from the Department of Economy), this causes difficulties for manufacturers as well. Permissions are granted, but only after a considerable delay. Manufacturers are also worried by the fact that in the event of war, supplies of soda ash would practically disappear and their only recourse would be to turn to the black market to obtain doubtful supplies.

In addition to scarcity of prime materials, Mexican producers of glass containers are faced with strong foreign competition despite protective measures granted by the Department of Economy in the form of import licenses and official control of imports.

Importation figures, complying with the fractional requirement of 3.34.40 (bottles, jars and flasks without carving or decoration of any sort), figured in pounds of glass, are as follows:

1934	165,646
1935	191,468
1936	231,189
1937	347,879
1938	321,525
1939	209,110
1940	213,127
1941	280,044
1942	498,344
1943	252,206
1944	319,962
1945	490,501
1946	493,743
1947	15,122,109
1948	6,682,672
1949	3,913,879
1950	2,492,406
1951	2,500,501 (for period from January to end of August)

The requirement for import permits, as well as other actions, have caused friction between glass manufacturers and importers. In effect, to expedite the granting of an import permission, the Department of Economy requires that the importer present a letter from a glass container manufacturer in Mexico which states he is unable to execute the order. The manufacturers usually do not wish to give these letters stating that they can produce the requested jars or bottles, if given sufficient time. Consumers, for their part, do not wish to wait and insist on immediate delivery, which obliges the manufacturers to refuse the orders.

Glass jar production in Mexico in 1951, produced with automatic machines, showed constant strength with monthly production well over 20,000,000 jars. Data is now available for the period from January to the end of September, 1951, and shows a total production of 235,475,014 pieces, according to data released by the Department of Economy. Production capacity is considerably greater but lack of materials and inability to fill orders promptly has forced certain manufacturers to inactivate many of their tanks.

Statistics for plate glass show that the glass industry produced (for the same January to September period) approximately 780,000 square feet.

There has been some small export of Mexican glass containers to the United States principally. One export firm recently shipped 11 million bottles to Wisconsin for the dairy industry there.

Prices of glass containers have risen approximately 16 per cent in the last eight months due to high cost of prime materials, wages and shipping costs.

The value of products produced by the industry has now passed 120,000,000 pesos (12,880,000 dollars). Salaries paid to workers have passed 25,000,000 pesos (2,893,500 dollars) annually and costs of prime materials needed have come to approximately 30,000,000 pesos (3,472,000 dollars) annually.

GLASS COMPANY ANNUAL REPORTS

Owens-Illinois Glass Company has announced that its sales in 1951 were up 10 per cent over the previous year, but net income dropped as a result of higher taxes, increased costs and price controls.

The company and its subsidiaries reported a net profit of $17,022,615.59, equal to $5.57 per share for the 12 months ended December 31, 1951, compared with $24,319,000.52, or $7.96 per share, in 1950. Provision for Federal and other income taxes increased to $31,428,000, or $10.28 per share, from the 1950 figure of $22,875,000, or $7.48 per share.

Sales at the end of last year climbed to $309,774,611.08 from $282,942,898.48 in 1950.

Net earnings of $15,476,754 in 1951, equal to $3.01 a share, resulting from record sales of $176,164,620, were reported by Libbey-Owens-Ford Glass Company.

Federal income tax, amounting to $34,000,000, or $6.61 a share, cut deeply into earnings, it was reported. In 1950 the company earned $24,752,425, or $4.82 a share, on $170,056,311 total sales.

High wages and other employee benefits resulted in a total outlay of $60,757,962 to an average of 11,480 employees in 1951.

• Norton Company will occupy Booth 1039 at the A.S.T.E. Industrial Exposition in Chicago, which is to be held March 17 to 21. The company will exhibit a variety of their products, including grinding wheels, abrasives and refractory products.

Research Digest

New Glasses for the Construction of Sodium-Vapor Discharge Lamps

It is well-known that the silicate and borosilicate glasses commonly used in the electric lamp and tube industry are attacked by sodium vapor and have to be protected by a resistant glass when used in the construction of sodium-vapor lamps. Previous investigations into the properties of glasses resistant to attack by sodium vapor have been of borosilicate glasses matching in thermal expansion properties the normal soda-lime-silica bulb glasses. Sodium discharge lamps are made in relatively small numbers by hand.

Due to the use of soda-lime-silica glasses with comparatively high thermal expansion coefficients, the lamp maker must have considerable skill if he is to make satisfactory U-bends and pinch seals. Lack of skill can easily lead to severe cracking troubles during lamp-making or, what is even more serious, during the sub-segment operation of the lamp. For some time, it has been considered that the use of borosilicate glasses with lower thermal expansion coefficients in place of the soda-lime-silica glass would so ease the lamp-maker's problems that better lamps could be made at a lower cost. This replacement also necessitates a corresponding change in the thermal expansion properties of the sodium-resistant glass and of the current lead wires.

The first possibility considered by the investigators (A. E. Dale and J. E. Stanworth, *Journal of the Society of Glass Technology*, August 1951) was to devise borate glasses of low thermal expansion coefficient and resistant to sodium vapor. While it was known that borate glasses with suitable thermal expansion properties could be made, these glasses contained certain oxides (for example, zinc oxide) which were known to have a detrimental effect on the resistance to attack by sodium vapor. There seemed to be a reasonable possibility that phosphate glasses would be resistant to the attack of sodium vapor. It was also thought it would be possible to produce a phosphate glass matching in thermal expansion properties the borosilicate glasses of the type used for sealing to iron-nickel-cobalt alloys of the Fernico or Kovar type.

The aim of the work described by the authors in this present paper, therefore, was to investigate the possibility of making sodium-vapor discharge lamps using a borosilicate glass having a protective layer of phosphate glass and using iron-nickel-cobalt alloy for the current leads to the electrodes.

Some previous investigations on phosphate glasses indicate that such glasses if properly compounded would give good resistance to sodium vapor discharge but that expansion coefficient was too high. A modification was made that resulted in a glass of the following composition: P_2O_5 21.6, B_2O_3 29.1, Al_2O_3 27.7, CaO 2.2, MgO 16.6, BaO 2.8, $\alpha \times 10^7 = 54$. While this glass could be worked fairly well in a flame, it showed dense devitrification at all temperatures between 1000°C. and 800°C. when heated in a gold boat along which there was a temperature gradient between 1000°C. and 675°C. The next step was to attempt to increase the resistance to devitrification and at the same time to try to simplify the glass composition. The resistance to devitrification was improved by increasing the P_2O_5 at the expense of the Al_2O_3 and MgO contents, and to simplify the glass, the BaO was replaced by CaO. This glass had a suitable thermal expansion coefficient and showed only slight devitrification at temperatures above 800°C. It was thought, however, that a further improvement in resistance to devitrification was necessary if the glass was to be used in production in the factory.

In several trial melts on a 100gm. scale, a further reduction in divalent oxide content decreased the resistance to devitrification. To find a composition with optimum properties, it was decided to melt a series of glasses of constant divalent oxide content with a systematic variation in the Al_2O_3, B_2O_3 and P_2O_5 contents. The results of these trials were given in triangular diagram which indicated the field in which resistance to devitrification was the greatest.

The next stage in the development was to make melts of the most promising glass on a scale sufficiently large to enable cased tubing to be drawn, using the phosphate glass as an inner layer on a borosilicate glass. These trials were made on a 10-pound basis.

As the 10-pound trials proved the possibility of making small quantities of tubing with excellent properties for the manufacture of sodium-vapor lamps, the next stage in the development was to melt the glass on a sufficiently large scale to enable production quantities of cased tubing to be made. Accordingly, the next step was in the order of 50 lb. melts using raw materials of commercial purity.

In order to test several refractory materials which were considered promising in their resistance to attack by the glass and the batch, small samples of pure aluminum bricks, "Corhart Zac" and "Monofrax MH" were tested by submerging them in a phosphate glass at 1300°C. for two hours, along with samples of china clay-ball clay mixtures. Alumina, "Corhart Zac" and "Monofrax MH" showed no signs of corrosion and did not color the glass. Due to the fact that pure alumina brick are available, this type is being used on a factory scale, although it is believed that "Corhart Zac" and "Monofrax MH" would be at least equally satisfactory.

After the check on corrosion resistance, a small day tank of 50-pounds capacity was built. With this furnace, the melting schedule is as follows: the batch is charged on when the temperature of the furnace is 1200°C., the temperature is increased to 1300°C. for three hours and then lowered to a working temperature of approximately 1060°C.

From a glass of the composition P_2O_5 15.1, Al_2O_3 22.5, CaO 5.5, MgO 13.0, SiO_2 7.3, B_2O_3 36.6, Fe_2O_3 0.03, batches of two-ply tubing have been prepared satisfactorily, using standard C40 borosolicate glass for the outer layer. Lamps have been made from this glass and life tests on these lamps have proven them to be satisfactory.

• Anchor Hocking Glass Corporation has announced the removal of its Terre Haute, Indiana Package Division branch sales and service office to 704 Sycamore Building, 19 South Sixth Street, Terre Haute.

Current Statistical Position of Glass

Employment and payrolls: During December 1951 employment in the glass industry continued to drop and was reported at a preliminary 123,100 persons. This is 1.2 per cent below the adjusted November employment figure of 124,600. During December 1950 employment was 127,400, or 3.3 per cent more than for December 1951.

Payrolls in the glass industry, according to preliminary reports, increased during December 1951 and were $35,878,726. This is 1.3 per cent higher than the $35,408,928 paid out during November 1951. Payrolls during December 1950 were $36,221,094.

GLASS CONTAINER SHIPMENTS

(All figures in Gross)

	January 1952
Narrow Neck Containers	
Foods	782,915
Medicinal & Health Supplies	1,163,016
Chemicals, Household & Industrial	593,750
Beverages, Returnable	511,277
Beverages, Non-returnable	14,012
Beer, Returnable	195,940
Beer, Non-returnable	645,389
Liquors	454,362
Wines	286,604
Toiletries & Cosmetics	528,244
Sub-total (Narrow)	5,175,509
Wide Mouth Containers	
Foods	*2,340,804
Dairy Products	258,009
Medicinal & Health Supplies	350,188
Chemicals, Household & Industrial	77,814
Toiletries & Cosmetics	125,177
Packers' Tumblers	156,163
Sub-total (Wide)	5,621,237
Total Domestic	8,483,664
Export Shipments	178,035
TOTAL SHIPMENTS	8,661,699

* This figure includes Home Canning.

GLASS CONTAINER PRODUCTION AND INVENTORY

(All figures in Gross)

		Production January 1952	Stocks January 1952
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial; Toiletries and Cosmetics	Narrow Neck	3,113,848	3,516,800
	Wide Mouth	*2,822,158	*2,757,039
Dairy Products		326,974	330,032
Beverages, Returnable		657,785	683,739
Beverages, Non-returnable		22,434	25,490
Beer, Returnable		275,370	285,337
Beer, Non-returnable		681,894	570,011
Liquors		567,822	976,036
Wines		302,084	359,292
Packers' Tumblers		133,088	95,386
TOTAL		8,903,457	9,599,162

* This figure includes Home Canning.

Glass container production, based on figures released by the Bureau of Census, started off the year with the first upward turn in several months to reach 8,903,457 gross during January 1952. This represents an increase of 17.1 per cent over the 7,602,943 gross produced during December 1951. During January 1951 production of glass containers was 10,278,883 gross, which is 13.3 per cent higher than production during January 1952.

Due to a clerical error, the preliminary 1951 annual glass container production was incorrectly reported in the January 1952 issue of THE GLASS INDUSTRY. This figure should have been reported as 117,692,359 gross.

Shipments of glass containers also took an upward turn after several months on the downgrade. January 1952 shipments were 8,661,699 gross. Compared with the previous month's shipments of 7,741,785 gross, an increase of 11.7 per cent is shown. During January 1951 shipments were 9,719,684 gross, or 10.8 per cent above January this year.

Stocks on hand at the close of January 1952 were 9,599,162 gross and were 1.5 per cent higher than the 9,452,721 gross on hand at the close of December 1951. Stocks at the close of January 1951 were 7,286,483 gross.

Due to a delay in the compilation of figures showing the production, shipment, and stocks of automatic tumbler ware and manufacturers' sales of machine-made table, kitchen and household glassware for January 1952, THE GLASS INDUSTRY is unable to publish these statistics in this issue. It is planned to include these data in this department in the April 1952 issue.

It is hoped that the Department of Commerce will be able to release statistics covering United States production, imports and exports of all types of glass and glassware for 1951 earlier than has been possible in the past—perhaps, by mid-year. In the meantime, THE GLASS INDUSTRY feels that the table reproduced on the opposite page, showing production, imports and exports from 1947 through 1950, will be of interest to its readers.

Detailed comment on these statistics is hardly necessary and the figures themselves clearly tell the story of American production and exports as compared with imports for all types of glassware.

Of striking interest, however, is the fact that the American glass manufacturing industry seems firmly established as a billion-dollar industry—over a billion two hundred million in 1950.

In practically all categories, production shows substantial gains in dollar values over the preceding years. Only handmade production, among these various divisions of the industry, shows a decline from previous production of 4.5 per cent.

With regard to the balance between exports and imports, it will be seen that in all categories—again, with the exception of handmade ware—the American glass industry is in a very favorable position. However, American manufacturers of handmade stemware are at a great disadvantage in their fight to hold the American market because of low wage rates and other factors obtaining in countries producing this type of ware.

GLASS AND GLASSWARE

UNITED STATES PRODUCTION, IMPORTS FOR CONSUMPTION, AND DOMESTIC EXPORTS, BY KINDS
YEARS 1947 TO 1950

Glass and Glassware	PRODUCTION 1/				IMPORTS (Foreign Value) 1/				EXPORTS 1/			
	1947	1948	1949	1950	1947	1948	1949	1950	1947	1948	1949	1950
FLAT GLASS - Total	$250,000,000 2/	$275,000,000 2/	$260,000,000 2/	$325,000,000 2/	$491,672 3/	$1,052,068 3/	$1,102,898 3/	$6,365,249 3/	$15,210,189	$11,548,652	$8,206,214	$7,112,496
GLASS CONTAINERS - Machine and Hand Made Total	400,000,000 2/4/	375,000,000 2/4/	375,000,000 2/4/	425,000,000 2/4/	365,078 5/	187,685 5/	251,463 5/	318,997 5/	28,479,902 4/	22,054,058 4/	19,587,271 4/	18,889,194 4/
PRESSED AND BLOWN GLASSWARE												
Tumblers, Stemware, Table, Kitchen, Cooking and Art Ware												
Machine Made:												
Tumblers and stemware	31,684,000	30,061,000	31,598,000	38,273,000					4,292,863	2,265,558	3,222,355	3,354,606
Value added by cutters and decorators	2,000,000 2/	3,000,000 2/	2,900,000 2/	3,000,000 2/					14,483,546	8,581,241	6,653,032	4,679,336
Other table, kitchen, cooking and art ware	50,137,000	42,845,000	39,861,000	45,197,000								
Value added by cutters and decorators	1,000,000 2/	1,000,000 2/	1,000,000 2/	500,000 2/								
Total Machine Made	84,821,000	76,906,000	74,959,000	86,970,000	6,085 4/	8,252 4/	7,025 4/	14,536 4/	18,776,409	10,846,799	9,875,387	8,033,942
Hand Made:												
Blown tumblers, stemware and other table, kitchen and art ware	18,262,000	18,388,000	16,156,000	15,741,000	2,977,348 6/7/	2,094,000 6/	2,294,000 6/	2,779,399 6/				
Value added by cutters and decorators	3,500,000 2/	3,000,000 2/	2,300,000 2/	2,000,000 2/								
Pressed tumblers, stemware and other table, kitchen, and art ware	14,844,000	16,252,000	14,581,000	13,769,000	251,186 6/	282,178 6/	289,382 6/	310,000 6/				
Value added by cutters and decorators	2,000,000 2/	1,500,000 2/	1,200,000 2/	1,200,000 2/								
Total Hand Made	38,606,000	39,140,000	34,237,000	32,710,000	3,328,534	2,376,178	2,583,382	3,089,399	1,107,567	408,096	346,755	333,234
Total Tumblers, Stemware, Table, Kitchen, Cooking and Art Ware	123,427,000	116,046,000	109,196,000	119,680,000	3,334,619	2,384,430	2,590,457	3,103,935	19,883,976	11,254,895	10,222,142	8,367,176
Illuminating Ware												
Globes, shades, bowls, etc	12,176,000	11,937,000	11,323,000	13,207,000	8,143	4,418	4,579	11,289	1,659,803	1,378,787	1,517,736	1,447,399
Lamp Chimneys and lantern globes	2,156,000	2,159,000	1,607,000	2,189,000	193	1,406	133	241	884,766	868,643	684,803	690,649
Other including prisms, lenses, light bulb blanks, electrical tubing, television, radio and other electronic blanks	44,093,000	49,203,000	64,026,000	117,872,000	844,337	1,780,879	1,858,260 8/	2,078,205 8/	9/	9/	1,887,044 9/	1,586,170 9/
Total Illuminating Ware	58,425,000	63,299,000	76,956,000	133,268,000	852,673	1,786,703	1,862,972	2,089,735	2,544,569	2,247,430	4,089,583	3,724,218
Technical, Scientific, Industrial and Other Pressed and Blown Ware - Total (Includes Christmas tree ornaments, glass blocks, insulators, and miscellaneous types of glass)	76,880,000 10/	71,782,000	63,266,000	78,448,000	483,516	896,850	1,447,707	2,344,946	13,396,796	11,418,302	9,303,263	7,952,739
Total Pressed and Blown Glass Industry	258,732,000	251,127,000	249,418,000	331,396,000	4,670,808	5,067,983	5,901,136	7,538,216	35,825,341	24,920,627	23,615,008	20,044,133
ALL OTHER GLASS AND GLASSWARE - Total (Includes optical glass and lenses, fibre glass, etc.)	80,000,000 2/	90,000,000 2/	105,000,000 2/	140,000,000 2/	39,092 11/	131,070 11/	112,115 11/	124,343 11/	141,640 12/	125,057 12/	1,635,633 12/	1,659,612 12/
GRAND TOTAL GLASS AND GLASSWARE	988,732,000	991,127,000	989,418,000	1,221,396,000	5,566,650	6,438,806	7,367,612	14,346,805	79,657,272	58,648,394	51,544,126	47,705,435

[1] Preliminary.

[2] Estimated.

[3] Relatively small imports of duty-free stained and painted glass windows and pictorial paintings on glass are included in another commodity group and are not shown on this table.

[4] Almost entirely machine-made.

[5] Largely hand-made.

[6] Almost entirely hand-made. Imports of kitchen articles are believed to be small. Imports of smokers' articles are included in another commodity group and are not shown on this table. Separation of these data into blown and pressed categories is based on trade estimates.

[7] Includes approximately $750,000 of glass jewelry which in later years is included in another commodity group not shown on this table.

[8] Includes $350,000 of television tubes, imported as blown or decorated (coated) glassware.

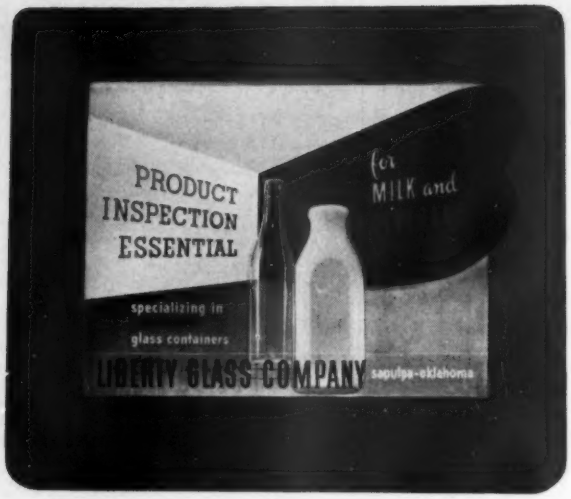
[9] Included under Technical, Scientific, Industrial and Other Ware, except for light bulb blanks which are shown for 1949 and 1950 only.

[10] Includes some products made of purchased glass, the value of which represents a slight duplication.

[11] Imports of camera and projection lenses and lenses fitted to instruments are included in another commodity group and are not shown on this table.

[12] Includes ophthalmic glass and blanks and certain fiber glass products in 1949 and 1950. Exports of sun and goggle glasses and ophthalmic and instrument lenses are included in another commodity group and are not shown on this table.

Source: U. S. Department of Commerce in Collaboration with U. S. Tariff Commission



LIBERTY GLASS ADOPTS NEW ADVERTISING MEDIUM

Liberty Glass Company is using a new medium for telling its story to the consuming public of the advantages of the glass container—specifically, for milk and beverage products. In the past, Liberty had only advertised through trade journals, limited radio programs, direct-mailing to its own customers, and other media directed to the users of its own products. Believing that the ultimate consumer of the products offered by Liberty's customers should also know the salient advantages of the glass container as a package for food, they decided on this new advertising medium for its products.

The St. Louis Union Station was selected as it is the gateway to Liberty's major markets and is one of the most important railroad terminals in the United States. There are 15 major railroads which terminate there daily. On the average, 4,750 trains enter and leave the St. Louis station each month and the terminal itself boasts a monthly traffic of 2,000,000 people.

A colorful, three-dimensional display is prominently affixed to the wall at the center of the train concourse. The display (see cut) points up the main advantages of glass containers by means of panels of copy which are changed once a month in order to vary the messages and keep the interest in the display at a high level. The general theme of the messages carried on this display will be product inspection, safety and taste.

The objectives of the display are not only to emphasize the advantages of the glass container, but to promote and increase the use of milk and carbonated beverages, thereby serving as a sales adjunct for Liberty to the dairy and beverage industries.

The use of this display permits the Liberty Glass Company to convey its consumer message to millions of people in an attractive, forceful, dignified way. The character of the advertising and the impressive environment in which it is seen will help promote public acceptance of the returnable glass container and gain recognition of leadership in the industry for Liberty Glass.

The display was created for Liberty by the McArthur Advertising Corporation, of New York and Chicago, who operates similar exclusive concessions in nine other major railroad terminals from coast to coast.

E. H. BALZ NAMED GLASS FIBERS RESEARCH DIRECTOR

Emil H. Balz has been appointed Director of Research of Glass Fibers Inc., according to an announcement by Randolph H. Barnard, President.

In the past, Dr. Balz has served as both a consultant to the glass company and had charge of the glass and plastic laminate laboratory. It was under Dr. Balz' direction that the "Vitron" continuous glass cloth treating process was developed at the Glass Fibers, Waterville, Ohio, plant. Glass cloth treated by the new process goes into aircraft radar-domes, flat sheet electrical panel boards for the U. S. Navy, backing material for aircraft wing fuel cells and many other glass-plastic applications.

Dr. Balz brings to Glass Fibers a wide experience in the field of chemistry. He was instrumental in early development work in the United States on aromatic chemicals in which field he developed over 500 processes. He is also credited with much of the early work in development of safety glass, now so widely used in the transportation field.

Dr. Balz received his Bachelor of Science and Master of Science degrees from Ohio State University and his doctorate of philosophy from the University of Pittsburgh in 1919. He was a professor of chemistry at the University of Pittsburgh and at Vanderbilt University and was a fellow of the Mellon Institute for fifteen years. He has been employed in research with the Multicolortype Company of Cincinnati and with the Pittsburgh Plate Glass Company. From 1937 to 1945 he was in charge of production for the then Plaskon Company (now Plaskon Division of Libbey-Owens-Ford Glass Company). From 1945 to 1949 he served as private consultant to Defiance Machine Works, DeVilbiss Company, and the Gerity-Michigan Corporation.

G. B. B. A. PRESIDENT APPOINTED TO WAGE STABILIZATION BOARD

Lee W. Minton, President of the Glass Bottle Blowers Association (AFL) has been appointed an alternate member of the Wage Stabilization Board by President Truman. The Wage Stabilization Board is made up of eighteen members representing labor, management and the general public.

Mr. Minton is also Co-Executive Secretary of the Anglo-American Council on Productivity which is devoted to increasing production through the interchange of technical "know-how" between England and the United States.

MANAGEMENT COURSE AT STATE UNIVERSITY OF IOWA

The College of Engineering, State University of Iowa, announces the thirteenth Summer Management Course to be held June 9 through June 21, 1952 in Iowa City.

It is an intensive course of factory managers, foremen, industrial engineers, methods and timestudy analysts, cost accountants and office executives. The areas of Production Planning, Job Evaluation, Motion and Time Study, Wage Incentives, Plant Layout, Quality Control, Supervisory Training, Labor Relations and Legislation, Organization and Policy, and Public Speaking are included.

The regular State University of Iowa teaching staff will be augmented by outstanding men from a variety of industries and other educational institutions.

New Equipment and Supplies

NEW HUB-TYPE GRINDING WHEEL

Norton Company, Worcester 6, Mass., has announced a new, reinforced, flexible, hub-type grinding wheel known as the Norton BFR wheel—"B", standard marking for resinoid; "F", fiber construction; and "R", reinforced. With the BFR, an operator can now rough grind, finish grind, and notch—all with the same wheel.

Designed for use on right angle or sander type portable grinders, this wheel is made of carded web material impregnated with abrasive grain. The company describes this wheel as light, possessing unusual strength due to patented construction, sufficiently flexible to permit blending of contours, and capable of doing a good polishing job.

Generally, the new BFR wheel will be used to smooth down welds, blend surfaces on contours, and notch risers in all kinds of castings. A particular feature of the wheel is the safety web built into its back. Should breakage occur, the web is designed to hold pieces together until the machine can be stopped.

PROTECTIVE FACE-SHIELD

Mine Safety Appliances Company, Pittsburgh 8, Pa., has announced a new protective face-shield which is designed to improve vision, eliminate "dead air" space, and relieve binding discomforts.

Increased production is promised by the comfort features that encourage full-time use of the face-shield, paying off in greater output per worker. Freedom of movement allowed by the new face protector also reduces the fatigue toll appreciably.

Called the MSA Chest-Mounted Face-Shield, the new protector, designed by MSA's Research Laboratories, is supported by easily adjusted neck and chest straps which provide balanced weight distribution. A soft pliable leather pad rests on the chest without pressure or binding.

The ready adjustment feature is carried over to the visor itself to provide maximum vision and protection while it can be set at any desired angle, height or distance. A metal hinge device enables the worker to make adjustments to individual requirements. Specific advantages are the complete relief from head strain which is provided by the assembly; allowance that is made for near-maximum ventilation; air gets to the worker's face from all directions to supplant the tiring "closed in" feeling identified with conventional face-shields. When necessary, visors are easily replaced.

CATALOGS RECEIVED

National Pallet Corporation, Oliver Building, Pittsburgh, Pa., has just released a new 16-page booklet which comprehensively covers the use and application of hardwood pallets for every phase of the materials handling industry.

Job-engineered and standard type pallets are illustrated, with suggested uses, load limits and other important data. The booklet also stresses the importance of selecting pallets from a single source of supply that can economically service operations from coast-to-coast.

Sylvania Electric Products, Inc., Lighting Division, 60 Boston Street, Salem, Mass., has announced publication of a new, 12-page, two-color bulletin, "The Why, When and How of Modern Lighting Maintenance."

Emphasizing the high cost of low lighting maintenance standards, the bulletin stresses that planned maintenance of both light sources and reflecting surfaces saves costly time and useful light. The bulletin outlines an 8-step program of planned fluorescent lighting maintenance suggesting: (1) check lighting levels regularly, (2) replace burn-outs promptly, (3) keep lamp and reflectors clean, (4) replace lamps systematically, (5) maintain light colored walls and ceilings, (6) maintain proper line voltage, (7) keep a stock of fixture parts, and (8) use labor-saving methods and equipment.

Particularly stressed in the bulletin are the advantages of planned group replacement of lamps as compared to "one-at-a-time" replacements.

Asworth Bros., Inc., Metal Products Division, 306 Shrewsbury Street, Worcester 4, Mass., has issued its new Catalog 51 entitled "Metal Conveyor Belts."

Devoted to working data for design, application and selection, the well-illustrated catalog discusses such subjects as belt applications in the basic industries, Range of Applications Classified as to Temperature, Metal Conveyor Belt Manufacture, Cataloging of Belt Designs and Specification Tables, Wire Specifications, Engineering Formulas, Installation and Operating Recommendations, etc. The catalog also contains installation photographs in the glass, ceramics, heat treating, food processing, and process industries.

Leeds and Northrup Company, 4934 Stenton Avenue, Philadelphia 44, Pa., is offering a new, 38-page catalog and buyer's guide, "Thermohms, Assemblies, Parts and Accessories." The entire line of general-purpose and specialized Thermohms that are being used in countless plant and laboratory applications to detect temperatures between —325 and +1000°F. with accuracies from ±0.018°F. to ±3.0°F. are fully described and illustrated.

The publication features a 5-page tabular guide which indicates the Thermohm to use for each of the numerous applications in the glass, chemical, ceramics, food and drug, etc., industries. The guide also describes how the Thermohm is used and tells where it is usually installed. Many additional pages provide information about the temperature conditions, corrosive agents, pressures, gaseous or liquid flows, and other process conditions to which the elements can be exposed. Illustrations also show many of the typical applications and the ways in which Thermohms are installed.

Selas Corporation of America, Philadelphia 34, Pa., has issued a new bulletin, "Selas Equipment for Fluid Processing . . . Liquids, Air and Other Gases," which describes the application of a wide range of equipment to precision processing of these fluids.

Heating liquids, in batches and continuously; liquid phase separation; and clarification, polishing and cold sterilization are described briefly. Liquid, dirt and petroleum vapor removal from air or gas; air and gas drying; and flow rate indication are other processing considerations included in the bulletin. Eight types of equipment used in fluid processing are illustrated.

Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa., has made available a new 38-page booklet which tells how to match a furnace to your particular heat-treating problem.

The new booklet, entitled "Harnessing Heat," describes each of twelve different types of furnaces, both gas and electric, and briefly outlines their chief field of application. A section devoted to special furnaces gives several typical examples of tailor-made furnaces designed to meet specific problems of heat-treatment and production rates.

The booklet also contains several pages of data describing material handling methods in furnaces, atmospheres suitable for heat-treatment of different metals, average general performance data, and a glossary of heat-treating terms.

LYNCH EXPANDS SALES AND SERVICE

Lynch Corporation has announced the expansion of its sales service. In line with this expansion, sales offices and warehouses were opened in New York and Atlanta. Similar facilities in Chicago are also scheduled to be ready in early March.

Frank K. Zimmerman, President, states the reason for the establishment of the new offices is to enable the corporation to better service the growing number of users of its precision machinery equipment.

SPRING DIFFRACTION SCHOOL SCHEDULED

North American Philips Company, Inc., will hold its twelfth X-ray Diffraction School at the company's plant, 750 South Fulton Avenue, Mount Vernon, New York, during the week beginning Monday, April 21, through Friday, April 25.

Basic subjects to be covered by prominent educators and scientists will include X-ray diffraction, new high and low temperature camera technique, fluorescence analysis, Geiger-counter X-ray spectrometer, and electron microscopy and electric diffraction.

The sessions involve extensive classroom and laboratory work and ample opportunity is provided for participants to discuss their own problems and to become familiar with actual use of all types of equipment. The final day is devoted to actual application problems and a group of guest speakers will give details on methods which are currently playing important functions in industrial laboratories and plants.

M. E. LEEDS, FOUNDER OF LEEDS & NORTHRUP, DIES AT 82

Morris E. Leeds, founder and Chairman of the Board of Leeds & Northrup Company, died at the age of 82 following several weeks' illness. He is survived by his wife, Mrs. Hadassah Moore Leeds, and two daughters, Mary Maule and Esther Hallet.

Mr. Leeds has been honored by many organizations. The Institute of Management gave him its Henry Lawrence Gantt Medal for industrial relations achievements; the Edison Medal of the American Institute of Electrical Engineers was awarded to him for the development and production of instruments and control. He received the Edward Longstreth Medal of the Franklin Institute for the invention of the instrument later known as the Leeds Recorder, which was the first balance-method industrial recording instrument. The Philadelphia Chamber of Commerce made him the first recipient of its Annual Award for leadership in industrial relations.

Mr. Leeds belonged to the American Institute of Electrical Engineers, American Association for the Advancement of Science, American Society for Testing Materials, American Physical Society, American Society for Metals, Academy of Natural Sciences, American Philosophical Society, Franklin Institute, Metal Manufacturers' Association of Philadelphia, and Association of Scientific Apparatus Makers of the United States.

• Bailey Meter Company, Cleveland, Ohio, has announced the appointment of W. Powell, Jr., as Manager of their branch office in Buffalo, New York.

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ANHYDROUS BORAX
ANHYDROUS RASORITE
BORAX—BORIC ACID
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Speeds fining rate
Improves durability . . . appearance
Container ware manufacturers are becoming increasingly aware of the merits of B_2O_3 as a minor constituent. A primary source of supply is the Pacific Coast Borax Co. with its continuous record of supplying highest quality boron compounds for more than fifty years. One single organization—from mine to refined product—assures top grade.
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WALSH MULLIFLUX TANK BLOCKS

Geared TO TODAY'S DEMAND FOR GREATER GLASS TONNAGE AT *LOWER COST*

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MULLIFLUX
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As an added convenience, distinctive markings on each block readily identify Cast Mulliflux "B" for Bottoms, "S" for Sidewalls.

A vacuum cast flux block of outstanding superiority, new Walsh Mulliflux meets today's need for increased production at less cost. The result of years of experimentation and testing that began during World War II, Walsh Mulliflux emerges as a refractory qualified to successfully cope with the most severe service conditions encountered in modern glass melting practice. Greater density, more uniform expansion and superior resistance to high temperatures and corrosion characterize this block, which is machine-trued to exact size and shape after burning at extremely high temperatures. For assurance of increased tonnage, longer life and maximum economy, insist on Walsh Mulliflux Tank Blocks. Write today for details.

OTHER WALSH PRODUCTS

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BOOK REVIEW

Materials Technology For Electron Tubes

By Walter H. Kohl

This book merits attention not only for its comprehensive and readable content, but also for its approach. The dilemma of technical book writing arises from the impossibility of one man accumulating enough experience and knowledge in even the more specialized fields to write with authority about all aspects. Kohl avoided the usual poles of the superficiality of a single authorship versus the lack of unity and coordination resulting from assigning individual chapters to super-specialists by assuming the entire writing burden but submitting each chapter to expert reviewers who supplied additional data and conciseness. At the beginning of the book, four pages are needed to list more than 55 acknowledged reviewers for the 19 chapters.

The purpose of the book is to present the physical characteristics of the solid materials used in the construction of electronic tubes and also some of the processes in which they are applied. Though written for designers, development engineers and technicians in the tube manufacturing industry, it collects much information which is useful for glass technologists, whether engaged in glass-making or in industries using glass as a starting material. This can be seen from the headings for the first six chapters: Physics of Glass, Annealing of Glass, Strain Analysis of Glass, Glass-to-Metal Seals, Electrical Conduction in Glass, and Glass in Radiation Fields.

It is noted that in 1947, before the boom in television was in high gear, the electronic-tube industry in the United States consumed $14,000,000 worth of glass blanks. (In 1949 this figure had jumped to $51 and one-half million and in 1950 to $102 million, Glass Ind., July 1951, Page 365.)

Chapters on the favorite metals for electronic tubes—tungsten, molybdenum, tantalum, nickel, copper—are introduced by a review of the fundamental concepts of metallurgy. The important roles of carbon and graphite in electronics are not neglected. Soldering and brazing are considered at length, and a comprehensive table of data compiled on solders and brazing materials. Each topic is discussed thoroughly without attempting to be exhaustive. Tables collect information, for instance, on sealing glasses, which previously could not be found without hunting through several sources.

In opening his discussion of ceramics and mica, Kohl states, after enumerating extensive uses of ceramics in the tube art: "There can be little doubt that a ceramist should be included on the staff of a modern tube laboratory. . . . All that this chapter can hope to convey is an appreciation of the complexity of this field and of its many applications in electronics." The tube designer and development engineer first turning to the references on ceramics find themselves confronted with a new terminology to which this chapter should serve as a guide. Words of caution about the importance of design considerations, of avoiding complicated shapes, are wryly highlighted by an illustration of a pagoda insulator designed by the author which fortunately makes a most attractive paper weight. The chapter treating ceramic-to-metal seals is thorough and up-to-the-minute.

Three appended chapters entitled: The Phase Rule, High-Vacuum Technique, and Thermionic Emission were included frankly because the author hated to discard the material collected and felt that the usefulness of his book would be enhanced by providing a guide to the monograph and journal literature and by including a number of tables. That is one criticism of the book. Too often a well-edited and concise summary of applications, physical characteristics and chemical properties of the material being discussed and excellent abstracts of well-selected classic papers in that specialty are followed by sketchy mention of papers or facts which are barely relevant, but had been discovered, treasured, and could not be abandoned. For example, on Page 349 in a discussion of raw materials for ceramics, we are told that siliceous rock for the lining of iron furnaces had to be transported by wagons over long distances. On Page 10 we learn that a fulgurite found in a sandpit near South Amboy, New Jersey, measured 9 feet in length. Such facts humanize the text but are scarcely helpful to the tube technologist. Another weakness is that some reviewers have been rewarded with a chance for self-advertising not necessarily pertinent or justified by historical facts.

Nevertheless, the extensive references and careful indexing are valuable guides to deeper exploration of the literature which Kohl succeeds in portraying as a quickening adventure.

Reinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y. 493 xv pages. Oct. 1951. $10.00.

GLASS FIBERS RESEARCH DEVELOPMENT

Quartz, the crystalline form of silica and the most perfect electrical insulating material found in nature, has been duplicated chemically in the form of fibers, it has been announced by Randolph H. Barnard, President of Glass Fibers, Inc.

Mr. Barnard stated that his company has produced a highly specialized glass fiber in the sub-micron-diameter size that has been successfully made into a quartz paper. The initial use of the new paper will be as a high-temperature, non-deteriorating electrical insulating material. It is chemically identical with nature-found quartz, Mr. Barnard said, which has long been regarded by science and industry as the finest insulator known. So far as his industry is concerned, Mr. Barnard further stated that quartz paper made from glass fibers will be looked upon as the greatest development since the invention of the automatic bottle blowing machine and flat glass manufacturing equipment.

Quartz paper, made from the new glass fibers, has high temperature resistance up to 3,000 degrees Fahrenheit, provides minimum electrical losses at high frequency and, in extensive tests, has proven relatively unaffected by radiation. It has strategic importance as a replacement for asbestos and with a temperature limit for the paper of 3,000 degrees F., it greatly surpasses the accepted working limit for asbestos. In addition, it does not break down chemically as is sometimes the case with asbestos and is absolutely magnitite-free.

• Professor David B. Hertz has announced that the 3rd Annual Conference on Industrial Research will be held at Columbia University, June 9 through 13, 1952. The Conference will have as its theme this year, "The Design of Research Operations."

- Finer Decorative Detail
- Increased Coverage
- Anti-Clogging

Harshaw's

WHITE GLASS ENAMEL

• Harshaw's white glass enamel, in impartial production runs, has decorated 8% to 35% more bottles per pound of glass enamel than other brands.

Also, sharper decorative lines and smaller letters are made possible with this new white glass enamel for decoration of glassware by the silk screen process.

Another important advantage is its anti-clogging properties. When production is resumed after a slow down or stoppage there is little or no smearing of your product. Harshaw's new white does not have the tendency to "seep thru" the silk screen.

Contact the nearest Harshaw branch office for additional information or quotation.

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CORHART TO BUILD NEW PLANT

Frederick S. Thompson, President and General Manager, has announced that Corhart Refractories Company, Inc., will build a new plant for the manufacture of a new refractory product for metallurgical use. This new open hearth furnace refractory, which has shown superior performance and life in laboratory and commercial tests in the steel industry, was developed by the Corhart research staff in its laboratories.

A factory building, approximately 80′ x 260′, will be built on a seven-acre site on the southeast corner of 16th and Lee Streets, Louisville, Kentucky. The plant is expected to be in operation late this year, barring possible critical material shortages. The building construction contract has been awarded to Sullivan & Cozart, Inc., of Louisville. Other work will be done by local contractors.

PENNSALT VICE PRESIDENT NAMED OPS DIVISION DIRECTOR

William P. Drake, Vice President of the Pennsylvania Salt Manufacturing Company, has been named Director of the Rubber, Chemicals and Drugs Division of the Office of Price Stabilization, according to an announcement by Michael V. DiSalle, OPS Director. Mr. Drake succeeds Thomas H. McCormack, who is returning to his duties as Director of Sales of the Grasselli Chemicals Division, E. I. du Pont de Nemours & Co., Inc.

As Pennsalt Vice President in Charge of Sales, Mr. Drake has headed the chemical company's nine sales departments. He joined the company in 1934.

PHILIP W. HATCH JOINS THATCHER

Philip W. Hatch has become associated with Thatcher Glass Manufacturing Company, Inc., in an executive capacity, according to an announcement by Franklin B. Pollock, President.

Mr. Hatch has been associated with Ball Brothers Company for the past twenty years, and for the past four years has been Manager of the company's Glass Container Sales Division.

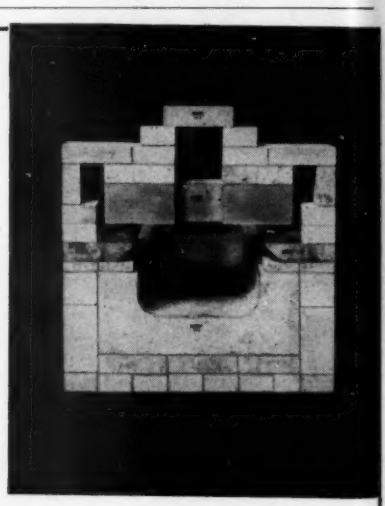
PACIFIC OPTICAL MOVES TO NEW QUARTERS

Completion of new Los Angeles plants for Pacific Optical Corporation, a subsidiary of McCulloch Motors Corporation, and for Paxton Engineering, a division of the same company, has been announced by Robert P. McCulloch.

In connection with its move into new quarters, Pacific Optical Corporation has completely overhauled and renewed the special machinery on which it mass produces optical products such as glass and plastic prisms and lenses. The company's facilities for grinding and polishing large optical blanks, up to 30 inches in diameter, include more than fifty spindles and, according to General Manager Fred C. Kaston, are among the largest in the nation for this type of work.

Dust and temperature, both of which are factors in precision optical work, are controlled throughout the entire plant by extensive air-conditioning equipment. Layout of the manufacturing portion of the plant was designed for efficiency in large-scale production.

Cleaner Glass, Low Maintenance with **CRYSTALITE Forehearths**



REMMEY CRYSTALITE (mullite-bonded mullite) is produced in all shapes necessary to make up the forehearth assembly. Burner blocks, cover blocks, channels, spouts, tubes, plungers and orifice rings are built to meet specified requirements. These CRYSTALITE parts mean better, more efficient production by offering:

- ★ Accuracy in formation to eliminate time-wasting adjustments.
- ★ High refractoriness and erosion resistance for longer life, fewer replacement shutdowns and cleaner glass.
- ★ Rigid control through each production phase for uniform quality and dimension accuracy.

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For more than ten years, *International* has been a major producer of potash salts at its mine near Carlsbad, New Mexico. Now, with its chemical manufacturing plant at Niagara Falls, New York, *International* provides for the first time in the industry a *three-way control* in the production of potassium chemicals. *Mining. Refining. Manufacturing. International's* basic position in the potash chemicals field assures effective control at every stage of production, and large tonnages of chemicals carefully prepared to specifications.

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INTERNATIONAL MINERALS & CHEMICAL CORPORATION

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DYNAMIC PROCESS CONTROLS . . .
(*Continued from page* 123)

handling program so that as complete an analysis of variables can be made as is possible. After these steps have been followed through, it is then possible to undertake the evaluation of "nearly controlled" experiments, such as "what furnace design or pull will yield the most consistent product?" or "which machine makes a certain job best, and why?" and many others.

V. Summary

We have shown here only some of the applications of three measurements. There are, of course, many more simple, routine measurements which could be used. The use, for example, of alkalinity (which can easily be expressed in equation form) and high temperature viscosity will yield exact chemical analysis for five of the major oxide components. Unfortunately there is a need for some rather high-powered mathematics and statistics in order to arrive at daily process controls and chemical analysis in a period of four hours per day, but it would seem well worthwhile for plants having marginal operation or those trying to achieve the elusive one hundred per cent pack.

Mold lubricants, mold design, and many other things will obviously enter into the final per cent pack picture. If, however, the studies are on the same shop, same pull, same job, and condensed in a small time interval, it would seem that per cent pack would vary *from an established average* with composition and the critical adherence temperatures of the molds.

We have noticed definite correspondence between variation of composition and furnace design and pull. There are not, however, enough relations present to draw absolute conclusions.

In this paper we have tried merely to indicate the measurements of some of the many complex variables in glass production. We do not mean to imply that this is the only system of evaluating glass variables on a production basis, but we do believe that it certainly is a step in the right direction. There are still many more variables remaining which must be evaluated before we will be in the position to say: "we are using the best batch and we are getting the highest efficiency *and* output which can be obtained on this particular furnace."

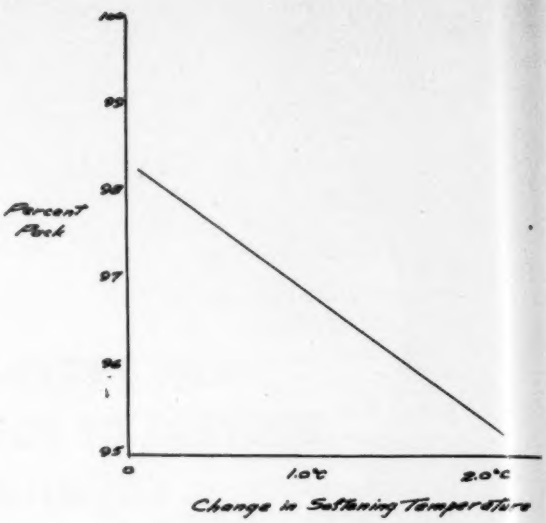


Fig. 6. Change in softening temperature versus per cent pack.

REFERENCE

[1] J. P. Poole, "Improved Apparatus for Measuring Viscosity of Glasses in Annealing Range of Temperature," J. Am. Ceram. Soc., 32 (7) 215-220 (1949).

GLASS EXHIBIT IN COLUMBUS

To help the general public to realize the variety of types and forms of glass and the versatility of its application, an extensive exhibit of glass products was presented February 1 through March 2 at the Columbus Gallery of Fine Arts. This presentation of the forms that glass is taking, ranging from the tiny jewel bearings for instruments and the fine fiber filaments to the huge structural shapes and the two-hundred inch astronomical mirror at Mount Palomar, was designed to dispel the general misconception that glass is a commonplace or even cheap material.

The choice of Columbus for the exhibit was fitting because of the part played by Ohio as the center of glass-making. The leading glass companies cooperated to present a cross-section of the results of the skill and technology that go into the final glass product.

SIX GLASS COMPANIES RECEIVE AWARD FOR EXCELLENT MANAGEMENT

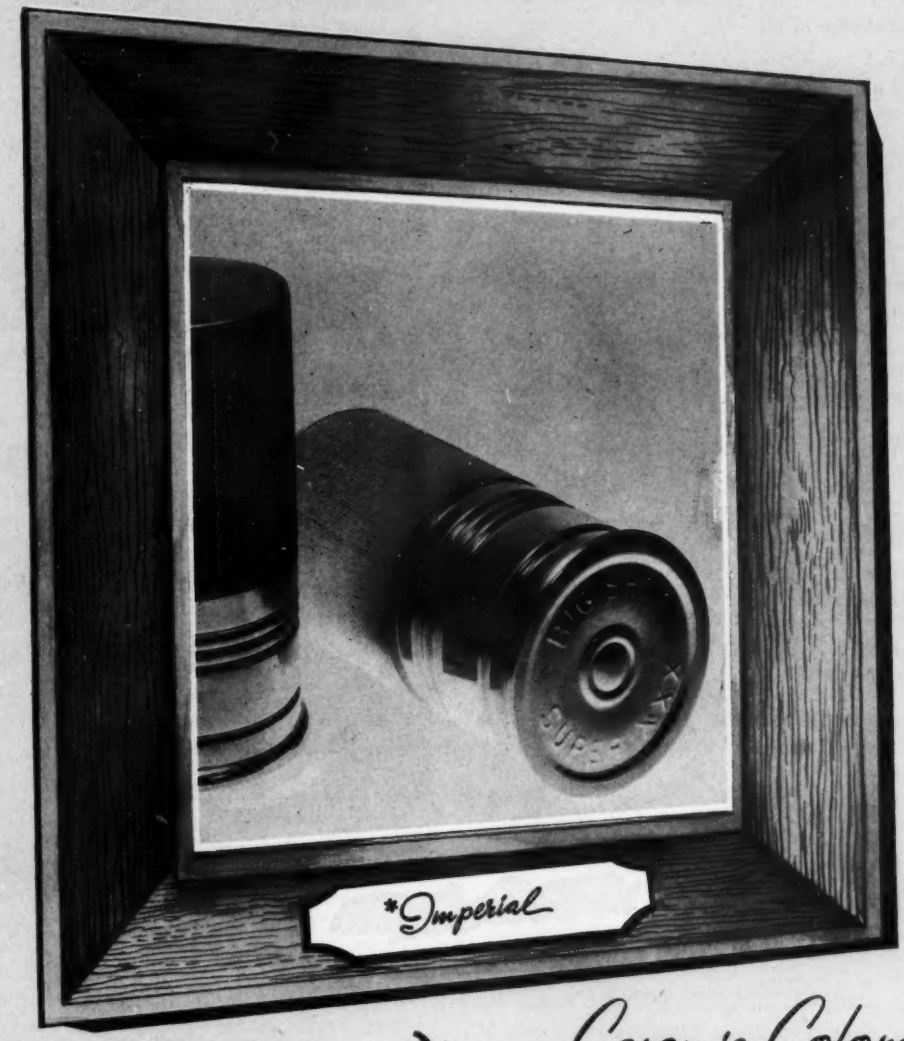
Six companies in the glass industry have been awarded Certificates of Management Excellence for the year 1951 by the American Institute of Management, a non-profit foundation devoted to the study and improvement of corporate organization and management.

The firms receiving the award include: Anchor Hocking Glass Corporation, Corning Glass Works, Hazel-Atlas Glass Company, Libbey-Owens Ford Glass Company, Owens-Illinois Glass Company and Pittsburgh Plate Glass Company. This is the second time these companies have been cited "excellently managed" by the Institute.

According to Jackson Martindell, President of the Institute, only 298 firms in the United States and Canada were deemed eligible to receive the awards. In deciding which companies are entitled to the designation, Mr. Martindell explained, credits are given for excellence in ten separate fields: economic function, corporate structure, health of earnings growth, fairness to stockholders, research and development, directorate analysis, fiscal policies, production efficiency, sales vigor and executive evaluation. In order to be certified by the Institute, a company must receive 7,500 points out of a possible 10,000. The point system used by the organization is based on a continuing comparative study of 3,000 concerns.

In addition to the above companies, it was also announced that Lynch Corporation, manufacturer of glass making machinery, was singled out for excellent management.

HOMMEL CERAMIC MASTERPIECE SERIES*



HOMMEL MATERIALS MAKE *Masterpieces*

Sales representatives throughout the world

Ceramic Colors

These "Big Shot" green tumblers with gold cap base to simulate shot gun shells were master crafted by hand at the Imperial Glass Corporation of Bellaire, Ohio. For YOUR own particular "masterpieces" in your own plant why not choose HOMMEL materials and supplies? No other supplier in the industry can furnish you with more quality or better service. HOMMEL'S vast experience in all phases and fields of ceramics is your assurance of strict uniformity with a durability, brilliance and beauty that bring your products to life!

THE O. HOMMEL CO. PITTSBURGH 30, PA.

POTTERY • STEEL AND CAST IRON FRIT
CERAMIC COLORS • CHEMICALS • SUPPLIES
Our Technical Staff and Samples are available to you without obligation. Let us help with your problems.

World's Most Complete Ceramic Supplier

Associate Company, ENGLAND, C. J. Baines & Co., Ltd., Stoke-On-Trent, Manufacturers of Porcelain Enamel Frit for Steel.

REBUILD TANK FURNACES . . .

(*Continued from page* 124)

Rebuilding Furnace

- **Working at edge of pit**

  Don't work too near edge.
  Keep all tools back from edge.
  Don't knock or drop anything into pit.

- **Working in pit**

  Be sure there is no loose brick or tools on ledge above you.
  Wear hard safety hat.

- **Loading trailer hopper**

  Block wheels if on a slope.
  Be sure dumping pin is in proper place.
  Don't mash fingers on side of hopper when shoveling.
  Don't overload.

- **Steel reinforcing and expansion rods**

  When working near these watch your head for bumps.

- **Handling broken furnace floor blocks with jagged glass attached**

  Wear gloves with leather palms.
  Use shovel wherever possible.
  Turn sharp edges from you.
  Do not lift heavy, sharp pieces by yourself—get help.
  Wear safety glasses.

- Be sure to put temporary guard railings around all pits and floor openings.

- **Loading brick**

  Balance load.
  Load as per instructions.
  Don't overload.
  If you must ride load, sit on a board.

- **Unloading brick**

  Don't hop a ride on an empty trailer. Walk.

- **Handling heavy shapes**

  Don't overlift—get help.
  Keep fingers out of way in final setting.
  Keep feet out of way—even safety shoes may not prevent mashed feet.
  Use mechanical aids where possible—chain hoists, hi-lifts, etc.

- **Caution on brick-cutting saws**

  Wear respirators (dry saw).
  Wear safety glasses.
  Use dust exhaust system with dust arrester.
  Test saw blades for defects before using.
  Never run saw at greater than recommended speeds.
  Stand out of direct line of saw as much as possible.

- Be sure to place guard rails around floor openings, especially at night.

- Ask outside contractors to observe our plant safety rules.

- Be sure no one is working under you who might be injured by a falling object.

1952 A. G. A. OFFICERS AND COMMITTEE MEMBERS

The recently elected Board of Governors of the American Glassware Association elected the following officers and committee members for 1952 at its first meeting held in Wheeling, West Virginia:

Chairman of the Governing Board: W. L. Orme, President of The Cambridge Glass Company; *Business Manager:* Stevenson, Jordan & Harrison, Inc.; *Secretary and Treasurer:* H. L. Dillingham, of American Glassware Association headquarters; *Public Relations Committee:* Chairman, C. W. Gustkey, President of Imperial Glass Corporation, and Vice Chairman, C. C. Stein, Sales Manager of Federal Glass Company; *Membership Committee:* Chairman, C. B. Roe, President (retired) of Fostoria Glass Company; W. C. McCartney, Secretary and Treasurer of The Cambridge Glass Company, and W. O. Kahn, Sales Manager of Gillinder Brothers, Inc.; *Foreign Trade Committee:* Chairman, C. W. Carlson, President of U. S. Glass Company; *Import Committee:* Chairman, H. E. Payne, President of Dunbar Glass Corporation; Vice Chairman, C. J. Uhrmann, Vice President of Imperial Glass Corporation; D. B. Dalzell, Sales Manager of Fostoria Glass Company; F. M. Fenton, President of Fenton Art Glass Company; T. C. Heisey, Jr., Asst. to the President of A. H. Heisey & Company; A. B. Orme, Vice President of The Cambridge Glass Company, and J. C. Weber, Jr., Vice President of West Virginia Glass Specialty Company; *Export Committee:* Chairman, M. E. Brown, Export Manager of Hazel-Atlas Glass Company; Vice Chairman, J. H. Winsche, Export Sales Manager of Corning Glass Works; F. G. Reuss, Foreign Trade Manager of Kimble Glass Company, and R. F. Murray, New York District Manager of Anchor Hocking Glass Corporation; *Traffic Manager:* Chairman, H. S. McCafferty, Traffic Manager of Federal Glass Company; E. E. Allison, Traffic Manager of Anchor Hocking Glass Corporation; J. A. Green, Traffic Manager of Corning Glass Works; R. F. Hannum, Vice President of Fostoria Glass Company; O. T. Myerhoff, Asst. Traffic Manager of Owens-Illinois Glass Company; G. O. Nickel, Traffic Manager of Bartlett-Collins Company, and J. L. Sprowls, Traffic Manager of Hazel-Atlas Glass Company.

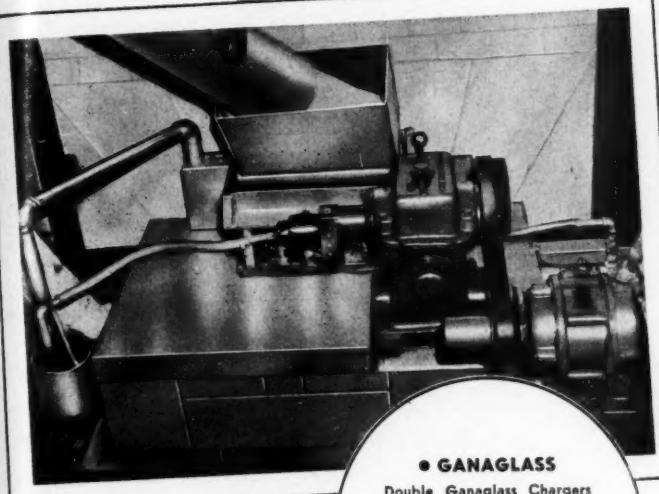
ARMSTRONG BOARD CHAIRMAN APPOINTED TO NAM COMMITTEE

H. W. Prentis, Jr., Chairman of the Board of Armstrong Cork Company, has been appointed Chairman of the International Relations Committee of the National Association of Manufacturers, NAM President William J. Grede has announced.

The Committee, a major policy-formulating group, is composed of about 140 manufacturers, large and small, from all parts of the country. It concerns itself with broad international issues affecting the economy with special emphasis on foreign aid programs, restoration of currency convertibility and multilateral trade, encouragement and protection of private international investment, technical assistance to under-developed areas, and relations with the United Nations.

THE GANAGLASS AUTOMATIC BATCH CHARGER

The GANAGLASS automatic batch charger was developed to fill a definite need in the modern glass industry for an automatic batch charger that would incorporate the following:



• GANAGLASS

Double Ganaglass Chargers are installed in tanks pulling 100 tons daily and up, in the United States. Single Ganaglass Chargers are installed in tanks pulling from 5 tons to 100 tons daily extraction, in the United States and abroad.

- Lower glass melting costs, through easily regulated and controlled batch feeding, and sealing-off of furnace dog-house.
- Ruggedly built, of modern design, yet with a reduced number of parts to simplify operation and maintenance, and minimize wear.
- Instantaneous regulation while operating.
- *Adaptable to large and small tank furnaces, either side port or end port fired.
- Easily installed in conventional type dog-houses, without the necessity of purchasing a large number of "special shapes".
- Economical to operate.
- Low in purchase cost.

The GANAGLASS automatic batch charger incorporates and meets the above requirements. It has been thoroughly tested in the glass industry in the United States for a number of years, and is today giving satisfactory service. Foreign installations have also been made • We would welcome the opportunity of adapting this batch charger to your needs.

• • •

Complete installations for the manufacture of bottles, tableware, window glass, tubing, and fiber, erected and in operation in various parts of the world. Glass melting tank furnaces, gas or oil fired • Automatic tube and rod drawing machines • Annealing lehrs, oil or gas fired • Automatic batch chargers • Automatic bottle blowing machines • Glass fiber drawing machines • Automatic lehr loaders.

GENERAL GLASS EQUIPMENT CO.

ATLANTIC CITY, NEW JERSEY

L-O-F APPOINTMENTS

Promotion of Galen M. Sollenberger to Manager of Defense Sales and George E. Hill, Jr., to Industrial Safety Glass Manager for Libbey-Owens-Ford Glass Company has been announced by G. P. MacNichol, Jr., Vice President.

Mr. Sollenberger, formerly Manager of Industrial Sales at the company's Dayton office, will work closely with L-O-F's growing manufacture of defense items for the government. He succeeds A. P. Plant, whose promotion to Manager of Industrial Sales was announced recently. Mr. Hill, formerly in charge of safety glass sales, has been transferred to the firm's industrial sales department and will be associated with Mr. Plant.

Mr. Sollenberger joined Libbey-Owens-Ford in 1946 and has served in the company's Dallas, Cleveland, Cincinnati and Dayton branch offices. Mr. Hill joined L-O-F in 1928 as a sales representative. He has formerly been associated with the company's Boston office.

Announcement has also been made of the promotion of two district managers. Harold J. Yerger, Manager of the Minneapolis distributor sales office for the past nine years, has been named Manager of distributor safety glass sales, and Edwin T. Law, Manager of the Toledo distributor sales office since 1942, has been appointed Manager of window glass sales.

Mr. Yerger joined L-O-F in 1929 at the East Toledo plant and in 1933 was transferred to the general offices in Toledo in the safety glass order department, remaining there for three years. He later served at company branches in Shreveport, La., Dallas, Denver and Minneapolis.

Mr. Law also joined the East Toledo plant of L-O-F, but he became associated with L-O-F in 1933. He was transferred to the sales department in 1935 and was assigned as a sales representative in the southeastern region. He was later assigned to San Francisco and St. Louis, and was appointed manager of distributor sales in Toledo in 1942.

LITHIUM CORPORATION MAKES APPOINTMENT

John E. Cordes, Ceramic Engineer, has been appointed to the staff of Lithium Corporation of America, Inc., Metalloy Corporation Division.

A graduate of the University of Illinois, Mr. Cordes received his B.S. in Ceramic Engineering in 1939. He joined the Metalloy staff in October 1951 and will now be active in the research, development and application of Lithium compounds to ceramic products.

DIAMOND ALKALI STAFF CHANGE

Diamond Alkali Company has announced that L. J. Polite, Jr., long active in chlorinated solvents sales, has been transferred to the company's Organic Chemicals Division. Mr. Polite will be attached to the sales staff of Kolker Chemical Works, a Diamond subsidiary specializing in organic chemicals for industry and agriculture.

The company's sales and service to chlorinated solvents customers will continue under the direction of C. M. Holt, Product Sales Manager for chlorine and its derivatives.

• DESIGN
• ERECTION
• OPERATION

of Glass Plants

DOMESTIC AND FOREIGN

Complete Glass Plants and Equipment, Batch Systems, Glass Melting & Sodium-Silicate Furnaces, Batch Feeders, "Schmid" Mechanical Gob Feeders, "Liberty" Pneumatic Gob Feeders, Automatic Handling Equipment, Stackers, Lehrs, Machines, etc. for manufacture of containers, flat glass, pressed ware, and tubing. Furnace Repairs and Rebuilding. Process Engineers.

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Cable address: "Schmid" Pittsburgh
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International Division: 444 Fourth Avenue
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Have you joined this trend?

As a result of recently completed panel tests, a growing number of tanks are being made like this one — with a balanced combination of MONOFRAX fused cast refractories. These 3 high alumina materials do what no *one* heavy duty refractory can possibly do. They give refractory teamwork. Their special talents work together to increase tank life and improve the quality of your glass.

MONOFRAX H material, for example, is ideal for superstructures. Containing over 99% beta alumina it is extremely resistant to high heat, flame impingement, and chemical reactions. With only 0.5% glassy matrix, defects caused by refractory drip are reduced sharply.

MONOFRAX K material is the most joint-erosion resistant refractory to be had, particularly where upward drilling may occur. Because of its over-all toughness, it is used in this tank under the first and second ports, in the doghouse, and in that part of the throat where attack is most severe.

MONOFRAX MH material, with a unique combination of high purity and erosion resistance, is used in the rest of this tank. It's the purest available refractory (less than 0.07% impurities). It's also one of the densest — therefore, it's highly resistant to erosion by molten glass.

Make it a point to test these materials in your next tank. Our engineers will gladly make recommendations to fit your particular operating conditions. There's no obligation, so check up — you owe it to yourself. For further data, address Dept. L-32, Refractories Div., The Carborundum Co., Perth Amboy, N. J.

Use fused cast refractories by

CARBORUNDUM

Trade Mark

for long campaigns...quality glass

"Carborundum" and "Monofrax" are registered trademarks which indicate manufacture by The Carborundum Company.

GLASS TANK FURNACES

(Translated from the French)

now available

The constant demand for this useful and informative book has necessitated another printing.

Glass Tank Furnaces is the only book in the English language dealing comprehensively with glass tanks. Its contents include and describe in simple language, the most modern practices in design, construction, operation, behavior and economy of glass tanks. It is a book for the factory man, the technologist and for all who are interested in the practical aspects of glass making.

Glass Tank Furnaces contains 105 figures and illustrations—75,000 words typed in two columns and produced by the lithoprint process. Paper bound, price $2.50. Foreign $3.00, F.O.B.

The edition is limited — Send the coupon now.

THE GLASS INDUSTRY
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New York 18, N. Y.

Date .....

Please enter my order for.....copies of Glass Tank Furnaces.

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QUALITY CONTROL CONVENTION TO BE HELD IN MAY

The Sixth Annual Convention of the American Society for Quality Control will be held May 22, 23 and 24, 1952. Convention headquarters will be the new Onondaga County War Memorial Auditorium.

Increased attendance over last year's convention is expected because of the greatly increased use of the techniques of statistical quality control demanded by Armed Forces Procurement Agencies.

GLASS FIRE HELMET

Introduced to fire departments early this year, according to *What's New in Safety*, a house organ of the E. D. Bullard Company, is an entirely new helmet built along the lines of the glass hard boiled hat so popular in industries. It brings to fire fighters a new conception in comfort, due primarily to the relatively light weight of 20 ounces. Impact resistance meets all standards.

Another advantage of the hard boiled fire helmet's molded Fiberglas construction is its natural insulation against heat. Radiation tests have proven them 10 per cent cooler. The helmet is moisture-, acid-, chemical-resistant, and is a non-conductor of electricity, which makes it safe to wear around electrical wires and installations.

Inner helmet assembly is the self-shaping, adjustable size headband style similar to that used in the hard boiled hat. Full ventilation is provided by the "floating" hammock, and wedge hangers permit headband removal and replacement in no more than a minute.

POLARISCOPES

for

Qualitative Observation

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POLARIMETERS

for

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POLARIZING INSTRUMENT CO., Inc.

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NEW VITROLITE COLOR

The newest color in structural glass is "taupe" Vitrolite. Taupe is a soft, grayish-brown shade, with mechanically ground and polished surface, and has just been announced by G. P. MacNichol, Vice President in charge of Sales of Libbey-Owens-Ford Glass Company.

The new color makes the seventh Vitrolite color, plus black and white. Recent defense restrictions applying to cobalt cut off the blue shades. The new taupe glass is made in 11/32-inch thickness and is available in stock sheets, cut sizes and ashlars.

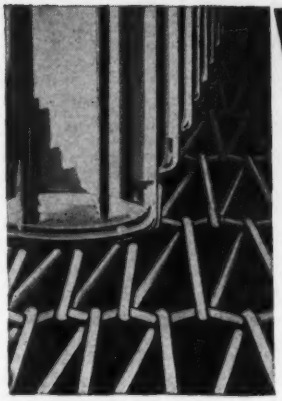
OWENS-ILLINOIS ACQUIRES SAMERIC, INC.

The business formerly owned by Sameric, Inc., of Riverdale, New Jersey, has been sold to Owens-Illinois Glass Company. The announcement was made jointly today by Owens-Illinois and the former owners of Sameric, Inc., Erich Gronemeyer and Samuel Cherba.

The corporate organization, known as Sameric, Inc., was dissolved on November 30. Owens-Illinois will acquire the Riverdale plant, machinery, equipment, raw materials and patent rights owned by the former owners and used in the business.

The plant, which employs thirty people, manufactures thermoplastic caps and closures for glass and metal containers and similar plastic articles.

The business will be operated under the direction of Gronemeyer and Cherba at the same location, as the Riverdale plant of the Closure and Plastics Division of Owens-Illinois.



WISSCO BELTS

assure trouble-free production schedules

Present-day demands for maximum production call for equipment that can be counted on to stand up and deliver dependable, uninterrupted service—particularly where punishing conditions are encountered.

Wisco Metal Processing Belts are specially engineered in various metals and alloys for long-lasting resistance to abrasion, corrosion and temperature extremes.

For additional information write or phone our nearest sales office.

THE COLORADO FUEL & IRON CORPORATION—Denver, Colorado
THE CALIFORNIA WIRE CLOTH CORPORATION—Oakland, California
WICKWIRE SPENCER STEEL DIVISION—Clinton, Massachusetts

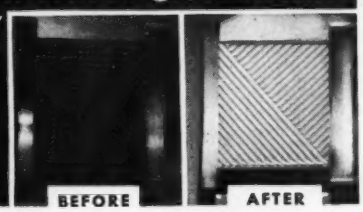
WISSCO BELTS
PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL & IRON CORPORATION
CF&I

AMCO

Design, Erection and Operation of Manufacturing Plants and Furnaces for All Types of GLASS WARE

AMSLER MORTON CORPORATION
CHAMBER OF COMMERCE BUILDING, PITTSBURGH 19, PA.

Hydro-Finish leaves glass molds READY for USE!

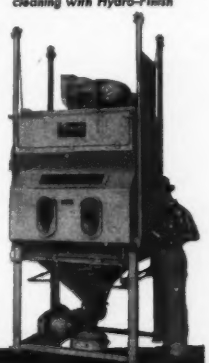


Complicated molds are easily cleaned and left *ready for use* with Pangborn Hydro-Finish! Hand cleaning and polishing is virtually eliminated! And you save additional time and labor because a Hydro-Finish machine, operated by one man, removes discoloration and scale in *minutes* instead of hours!

What's more, Hydro-Finish's use of fine-mesh abrasives suspended in liquid gives you a precision job. Sharp edges are maintained . . . tolerances are held to .0001 . . . molds last longer . . . precision equipment is protected.

Get complete facts on Hydro-Finish and how it can save *you* money! Write for Bulletin 1400-A to: PANGBORN CORP., 3400 Pangborn Blvd., Hagerstown, Md.

Actual unretouched photos of mold before and after cleaning with Hydro-Finish



Pangborn
BLAST CLEANS CHEAPER
with the right equipment for every job

GEORGE WASHINGTON SHOPPED . . .
(*Continued from page* 125)

mission free, under the sponsorship of The Landmarks Society of Alexandria. The Society also sponsors an antique shop next door that specializes in antique glassware. It is through the profits of this shop that the apothecary shop with its historic pharmaceutical collection is maintained for the American public.

BOOK REVIEW

Phase Transformations in Solids

By R. Smoluchowski, Chairman, J. E. Mayer, W. A. Weyl
Sponsored by the Committee on Solids, Division of Physical Science, National Research Council

This book is the result of a symposium held at Cornell University which brought together scientists from many different fields who had a common interest in the fundamental phenomena accompanying phase changes. The book itself is made up of papers presented at the symposium, plus the discussion of these papers. An Editorial Committee, headed by Dr. R. Smoluchowski of Carnegie Institute of Technology, prepared the papers and discussion for publication.

The first six chapters of the book deal with theoretical material; Chapters 7-12 with non-metals; and Chapters 13-17 with metals. Of interest to the glass industry is Chapter 11 which is devoted to Transitions in Glass by Woldemar A. Weyl of Pennsylvania State College.

This chapter is a discussion of structural changes that take place in a glass primarily as functions of temperature and time. Included in the section is a Definition of Glass, Formation of Glass, Types of Transformation Possible in Glasses, Structural Changes in Glasses Caused by Temperature and Heat Treatment, Structural Changes in Glasses Caused by Pressure, Changes Caused by an External Electric Field, Properties of Glasses as Affected by Structural Changes, and the chapter closes with a Summary and Discussion by Herbert Insley of the National Bureau of Standards.

Published by John Wiley & Sons, Inc., New York, New York, and Chapman & Hall, Ltd., London, England, 660 pages, $9.50.

AMERICAN POTASH APPOINTMENT

The appointment of John O. Pritchard as head of the new Process Evaluation Division of the Research Department of American Potash & Chemical Corporation has been announced by W. A. Gale, Director of Research for the company.

Mr. Pritchard received his bachelor's degree in chemical engineering from the University of Wisconsin in 1941. From 1941 to 1952 he was with the Engineering Department of E. I. du Pont de Nemours & Company. For seven years he served as a field engineer in process and development groups working with pigments and organic chemicals. For the past three years he has served as a production supervisor at the Grasselli Chemicals Department plant of du Pont at East Chicago, Indiana.

PENNSALT *Aqueous Hydrofluoric Acid*

• For pickling stainless steel
• For polishing and etching glass

Available: 60% and 70% commercial grades. Packed in: 165, 450, and 900 pound steel drums. Shipped from: Cornwells Heights, Pa. • Natrona, Pa. • Calvert City, Kentucky.

PENNSYLVANIA SALT MANUFACTURING COMPANY
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PENNSALT CHEMICALS
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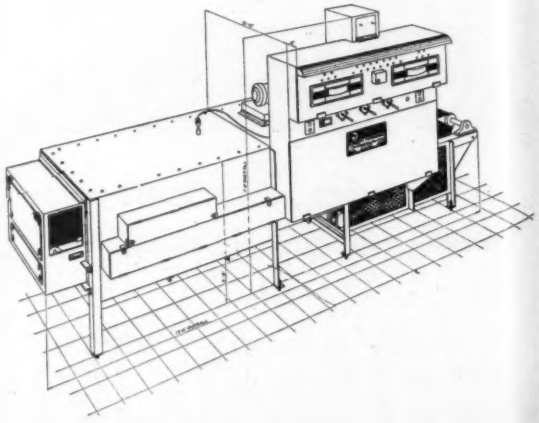

● Above illustration shows a special electric oven for the annealing of light ware as required for the electronic field.

Our knowledge of glass factory problems is your assurance of first quality glass melting and manufacturing equipment, as well as top service and performance.

We shall be pleased to consult with you concerning your manufacturing problems.

HENRY F. TEICHMANN, INC.
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A. C. S. SECTION MEETINGS

Feature of the American Ceramic Society's Pittsburgh Section April meeting will be "Movie Night." For the entertainment and education of the members, a sound and color movie entitled "Glass for Science," prepared by the Corning Glass Works, will be shown.

The movie depicts the many novel operations in the production of glass, particularly glass specialties. Unusual operations in the fabrication of glass are illustrated and automatic production machines, such as the type in which light bulbs are formed, have been photographed. In addition to this film, a comedy and newsreel will complete the program.

At the March meeting of the Central Ohio Section, Dr. Richard P. Goldthwait, Department of Geology of Ohio State University, will be the speaker. In his illustrated talk, entitled "Glaciers in Ohio," Dr. Goldthwait will describe the two glacial periods in Ohio, the formation of glacial deposits including clays, the nature of glacial erosion, and the effects of the disappearance of the glaciers on the terrain of Ohio.

CANADIAN CERAMIC SOCIETY ELECTS OFFICERS

The following officers were elected for the 1952 term of the Canadian Ceramic Society at the 50th annual convention held recently in Niagara Falls, Ontario. *President*, H. C. Bates of Corning Glass Works of Canada, Ltd.; *Vice President*, Ryland J. New of National Sewer Pipe Company; *Secretary*, Howells Frechette, and *Assistant Secretary*, L. C. Keith.

CLASSIFIED ADVERTISEMENTS

POSITION WANTED

A man who has had several years experience in quality and production control ih a plant making a wide variety of glass products would like to make a change. For further particulars write Box 115, c/o The Glass Industry, 55 West 42nd Street, New York 18, New York.

WANTED

Need for production: Simpson Mixer, Raymond Mill, one or two Vibrating Screens. Please give full particulars. P. O. Box 1351, Church Street Station, New York 8, New York.

FOR SALE

Approximately 7800 lbs. Binney Casting Minnox round 12-inch sticks. Size range 1½" to 3½". Make us an offer. Brockway Glass Co., Inc., Brockway, Pa.

Ferguson Packomatic Automatic Bottom Gluer. Assembly 31 ft. 6"; Drier 49 ft.; will glue 45 cartons per minute. Excellent condition. Can be seen in operation; full line spare parts included. $2500.00 Cash or Certified Check F.O.B. car or trucks, Brockway, Pa. Brockway Glass Company, Inc., Brockway, Pa.

REMMEY COMPANY MAKES APPOINTMENT

The Richard C. Remmey Son Company has announced that Robert W. Highley has joined its staff as Sales Service Representative for the Cleveland, Ohio, area.

Mr. Highley was formerly with the Harbison-Walker Refractories Company.

Our Moulds Don't Cost--They Pay

An Order a Day Will Keep Overmyer Away

OVERMYER MOULD COMPANY, Inc.

Factories at

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PRECISION GLASS CUTTING

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LAMP AND ELECTRONIC TUBE INDUSTRIES

The Engineering Glass Laboratory Inc. is completely equipped for cutting all types of glass tubing to very close tolerance specifications.

Our many years of experience and "know how" in servicing many of the leading companies is your assurance of receiving top quality workmanship.

Our Engineers will be glad to consult with you on any of your glass cutting problems.

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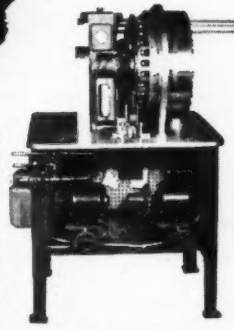
#1507
HIGH SPEED AUTOMATIC GLASS TUBING CUTTING MACHINE



High production on specific diameters. 30 head, continuous drive. Variable speeds. Length of cut adjustable. 7500-15,000 pieces per hour.

All Kahle equipment is custom-made — we don't turn out *stock* machinery. That's why we can do a better job for you — all our engineering skill and experience is concentrated on your specific glass manufacturing or finishing problem.

We're Specialists in equipment that cuts costs, increases production, assures uniformity in the manufacture of: ampules • cathode ray tubes • standard, miniature, sub-miniature radio tubes • sub-miniature tubes • fluorescent lamps • incandescent lamps • photocells • x-ray tubes • glass products.

Consult Kahle! There's no obligation. Write for our complete, new catalog today!

Kahle ENGINEERING COMPANY
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